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AYER AND SCHUH · Rates of Return on Agricultural Research

LIANOS AND PARIS · American Agriculture and Misery

RAY AND HEADY · Farm Programs and Commodity Interaction

KAWAGUCHI AND MARUYAMA · Generalized Constrained Games

FOOTE, CRAVEN, AND WILLIAMS · Quarterly Models for Pork Bellies

STEVENS AND GODFREY · Public Range Investments

SHORT ARTICLES AND NOTES

PASOUR—Rights of Holders of Government Allotments

CARMAN—Tax Loss Agricultural Investments

ORAZEM AND THOSTLE—Local Nonproperty Taxes

GUNNELSON, DOBSON, AND PAMPERIN—Accuracy of Crop Forecasts

DORAN AND QUILKEY—Harmonic Analysis of Data

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SCOTT AND BAKER—Optimum Farm Plan under Risk

HALLBERG—Systems Management

SMITH—Marketing Research for Less-Developed Areas

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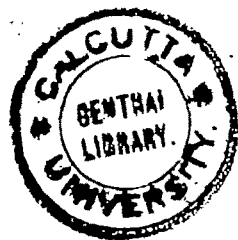
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Vol. 54 No. 4 Part I November 1972

ARTICLES

- Social Rates of Return and Other Aspects of Agricultural Research: The Case of Cotton Research in São Paulo, Brazil.....*Harry W. Ayer and G. Edward Schuh* 557
- American Agriculture and the Prophecy of Increasing Misery.....*Theodore P. Lianos and Quirino Paris* 570
- Government Farm Programs and Commodity Interaction: A Simulation Analysis.....*Daryll E. Ray and Earl O. Heady* 578
- Generalized Constrained Games in Farm Planning.....*T. Kawaguchi and Y. Maruyama* 591
- Quarterly Models to Predict Cash Prices of Pork Bellies.....*Richard J. Foote, John A. Craven, and Robert R. Williams, Jr.* 603
- Use Rates, Resource Flows, and Efficiency of Public Investment in Range Improvements.....*Joe B. Stevens and E. Bruce Godfrey* 611

SHORT ARTICLES AND NOTES

- Legal and Economic Rights of Holders of Government Allotments.....*E. C. Pasour, Jr.* 622
- Tax Loss Agricultural Investments After Tax Reform.....*Hoy F. Carman* 627
- Evaluation of Local Nonproperty Taxes for Rural and Urban Areas in Kansas.....*Frank Orazem and Ronald G. Trostle* 635
- Analysis of the Accuracy of USDA Crop Forecasts.....*G. Gunnelson, W. D. Dobson, and S. Pamperin* 639
- Harmonic Analysis of Seasonal Data: Some Important Properties.....*H. E. Doran and J. J. Quilkey* 646
- A Note on Uncertainty and Nonmarket Costs.....*Duane Chapman* 652
- Economies of Size and the Spatial Distribution of Land in Farming Units.....*Warren E. Johnston* 654
- A Practical Way to Select an Optimum Farm Plan under Risk.....*John T. Scott, Jr. and Chester B. Baker* 657
- Assembly and Distribution System Management: An Application of Lockset.....*M. C. Hallberg* 661
- Agricultural Marketing Research for Less-Developed Areas.....*Eldon D. Smith* 666
- Consumer Attitudes and Their Impact on Fluid Milk Demand in Hawaii—A Component-Regression Analysis Approach.....*Nittala V. Ratnam and Heinz Spielmann* 671

COMMUNICATIONS

- A Second Look at the Impact of Differential Assessment of Farmland and Consequent Tax Shifting
Comment.....*Robert N. Schoeplein and Justine Dakin Schoeplein* 679
Reply.....*C. T. K. Chung and G. E. Frick* 682

Optimal Levels of Fertilization Under Risk	
Comment.....	Richard K. Perrin 683
Reply.....	Alain de Janvry 685
Economics of Cropshare, Once Again	
Comment.....	Kwan S. Kim 686
Reply.....	Robert F. Boxley 688
An Analysis of the Market for Food Stamps: Correction and Extension.....	W. Keith Bryant 689
Needed: More Efficient Use of Computer Resources.....	Eddy L. LaDue and Doyle A. Eiler 693

BOOK REVIEWS

Ball, A. Gordon, and Earl O. Heady, eds., <i>Size, Structure, and Future of Farms</i>	W. L. Gibson, Jr. 695
Brubaker, Sterling, <i>To Live On Earth</i> ; Barkley, Paul W., and David W. Seckler, <i>Economic Growth and Environmental Decay: The Solution Becomes the Problem</i> ; and Boulding, Kenneth E., Elvis J. Stahr, Solomon Fabricant, and Martin R. Gainsburgh, <i>Economics of Pollution</i>	A. Allan Schmid 696
Dorner, Peter, ed., <i>Land Reform in Latin America, Issues and Cases</i>	C. O. Andrew 698
Geer, Thomas, <i>An Oligopoly: The World Coffee Economy and Stabilization Schemes</i>	M. M. Veeman 699
Grogan, F. O., <i>International Trade in Temperate Zone Products</i> ; and John W. Evans, <i>The Kennedy Round in American Trade Policy: The Twilight of the GATT?</i>	Vernon L. Sorenson 700
Padberg, Daniel I., <i>Today's Food Broker: Vital Link in the Distribution Cycle</i>	Bob R. Holdren 701
Takayama, Takashi, and George G. Judge, <i>Spatial and Temporal Prices and Allocation Models</i> ..	Pinhas Zusman 701

BOOKS RECEIVED	703
----------------------	-----

ANNOUNCEMENTS	705
---------------------	-----

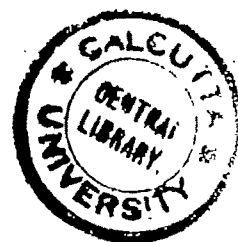
NEWS NOTES	710
------------------	-----

OBITUARIES	714
------------------	-----

AMERICAN JOURNAL OF AGRICULTURAL ECONOMICS

VOLUME 54 PART II

NOVEMBER, 1972



CONTENTS

	Page
Foreword.....	B
Abbreviations.....	C
Facsimile of Questionnaire Sent to Members.....	F
Alphabetical List of Members.....	1
Classification of Members According to Fields of Specialization.....	287
Geographical List of Individual Members.....	311
Geographical List of Journal Subscribers.....	348
Geographical Analysis of Members and Journal Subscribers.....	385
Sustaining Members.....	390
Awards Offered and Winners.....	392
The Beginnings of the American Agricultural Economics Association.....	411
Charter Members.....	413
Fellows of the American Agricultural Economics Association.....	415
Annual Meetings and Officers of the American Agr. Economics Association.....	416
Constitution of the American Agricultural Economics Association.....	419
By-Laws of the American Agricultural Economics Association.....	423
A Statement of the Objectives of the American Agr. Economics Association.....	431

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FOREWORD

A handbook-directory which includes short biographical sketches of the members and other information about the Association and its activities is published for the members of the American Agricultural Economics Association at about five-year intervals. The last was published in 1966. For the directory in hand the biographical sketches were prepared from information supplied by the members. Questionnaires were mailed to members in Summer 1971. No follow-up was made. Some individuals did not respond with the information soon enough for it to be used and only the names and addresses could be shown.

Some information asked for in the questionnaire was not included in the handbook. This was partly to limit the size of the handbook and partly because some respondents failed to present the information in usable form.

The user of this directory in reading the biographical sketches is invited to refer to the questionnaire and the list of abbreviations which follow on the next few pages. For ease of reading, the condensed sketches follow a common format and common abbreviations were used. The order for the information in the biographies follows that of the questionnaire. The activities are listed in the order given by the individual. The individual's main field of interest is written out in abbreviated form with letters to show secondary fields. These are the letters shown in the questionnaire. In the listing of individuals by specialization the letters following the name again show the second, third, and fourth fields and again correspond to the letters and fields shown on the questionnaire.

In preparing this handbook-directory the editorial work, sorting of names and typing were done by my very capable office personnel, Mrs. Willetta Hager, Mrs. Michelle Stokes and Mrs. Peggy Riley (temporary employee).

John C. Redman

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Vol. 54 No. 5 December 1972

FELLOWS OF THE AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION

1972 AAEA FELLOW

AAEA PRESIDENT 1972-1973

PRESIDENTIAL ADDRESS

Economics and the Quality of Life.....*Emery N. Castle* 723

INVITED ADDRESS

Southern Tradition and Regional Progress: A Perspective from the 1970's.....*William H. Nicholls* 736
Discussion.....*James G. Maddox* 745
Discussion.....*J. J. Spengler* 747

Seminar Session 1.0—AGRICULTURAL PRODUCTIVITY AND ENVIRONMENTAL QUALITY

Agricultural Productivity, Technology, and Environmental Quality.....*J. Charles Headley* 749
Discussion.....*Arlo W. Biere* 757
Discussion.....*James C. Hite* 759
Discussion.....*Herbert H. Stoevener* 761
Papers and Participants, Subsessions 1.1 through 1.5..... 763

Seminar Session 2.0—COMMUNITY DEVELOPMENT

Community Development in the 1970's.....*R. J. Hildreth and W. Neill Schaller* 764
Discussion.....*John S. Bottum* 773
Discussion.....*Gene McMurtry* 776
Papers and Participants, Subsessions 2.1 through 2.7..... 778

Sectional Meeting A—AGRIBUSINESS RESEARCH

Statistical Vs. Judgment and Audience Considerations in the Formulation and Use of Econometric Models.....*Richard T. Crowder* 779
Combining Statistical Techniques with Economic Theory for Commodity Forecasting.....*Walter M. Myers* 784
Allocation of Random Supply of Tomatoes of Varied Quality Produced in Different Areas Among Plants Producing Multiple Product Lines.....*Harvey H. S. Kuang* 790
An Industrial Perspective on Agricultural Policy in the 1970's.....*Willard R. Sparks* 797
Papers and Participants, Subsections A.1 through A.6..... 800

Sectional Meeting B—APPLIED WELFARE ECONOMICS

Agricultural Technology and the Distribution of Welfare Gains.....	<i>Jurg Bieri, Alain de Janvry, and Andrew Schmitz</i>	801
Welfare Analysis of Poverty Programs.....	<i>D. Lee Bawden</i>	809
Discussion.....	<i>Richard A. King</i>	815
Discussion.....	<i>B. Delworth Gardner</i>	817
Papers and Participants, Subsections B.1 through B.3.....		819

Sectional Meeting C—COMMODITY TRADE IN THE 1970'S

The Policy Environment for U. S. Agricultural Trade.....	<i>Gary L. Seevers</i>	821
World Trade Prospects for U. S. Agriculture.....	<i>Quentin M. West</i>	827
Discussion.....	<i>William R. Pearce</i>	834
Discussion.....	<i>Ted Rice and Vernon McMinimy</i>	836
Discussion.....	<i>Wallace Barr</i>	837
Discussion.....	<i>Robert C. Tetro</i>	840

GENERAL SESSION—EDUCATION AND DEVELOPMENT

The Increasing Economic Value of Human Time.....	<i>Theodore W. Schultz</i>	843
Causes and Consequences of Higher Education: Models of the Status Attainment Process....	<i>William H. Sewell and Robert M. Hauser</i>	851
Discussion.....	<i>Luther Tweeten</i>	862
Discussion.....	<i>Bruce K. Eckland</i>	863

Seminar Session 3.0—OUR OBSOLETE DATA SYSTEMS

Our Obsolete Data Systems: New Directions and Opportunities.....	<i>AAEA Committee on Economic Statistics</i>	867
Discussion.....	<i>John E. Lee, Jr.</i>	875
Discussion.....	<i>Edgar S. Dunn, Jr.</i>	878
Papers and Participants, Subsessions 3.1 through 3.4.....		880

Seminar Session 4.0—FOREST RESOURCE POLICY AND MANAGEMENT

Public Pressures and Values, Federal Policy Changes, and Future Timber Supply.....	<i>John Muench, Jr.</i>	881
Discussion.....	<i>Richard A. Skok</i>	887
Discussion.....	<i>Con H. Schallau</i>	889
Discussion.....	<i>James G. Yoho</i>	890
Papers and Participants, Subsessions 4.1 through 4.3.....		892

Seminar Session 5.0—INSTITUTIONAL ECONOMICS

Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment.....	<i>A. Allan Schmid</i>	893
Discussion.....	<i>David J. Allee</i>	901
Discussion.....	<i>William E. Martin</i>	903
Discussion.....	<i>Joseph W. Little</i>	905
Papers and Participants, Subsessions 5.1 through 5.4.....		908

Sectional Meeting D—ANALYTICAL METHODS IN AGRICULTURAL ECONOMICS

Papers and Participants.....		909
------------------------------	--	-----

Sectional Meeting E—CONTINUING EDUCATION IN THE 1970'S

Clientele for Continuing Education in the 1970's.....	<i>B. F. Stanton</i>	910
Delivery Systems for Continuing Education.....	<i>Lee R. Kolmer</i>	916
Research Support for Continuing Education.....	<i>Ludwig M. Eisgruber</i>	922
Discussion.....	<i>T. T. Williams</i>	928
Discussion.....	<i>Ken D. Duft</i>	930
Papers and Participants, Subsections E.1 through E.2.....		933

FELLOWS ADDRESS

Allocations of Colleges and Economists	<i>Earl O. Heady</i>	934
--	----------------------	-----

GENERAL SESSION—HIGHER EDUCATION IN THE 1970'S

Papers and Participants		44
-------------------------------	--	----

Sectional Meeting F—THE MARKET FOR ECONOMISTS IN THE 1970'S

Papers and Participants		944
-------------------------------	--	-----

Sectional Meeting G—THE ECONOMICS OF ZERO GROWTH

In Defense of a Steady-State Economy	<i>Herman E. Daly</i>	945
--	-----------------------	-----

The Implications of Zero Growth for Agricultural Commodity Demand...	<i>William J. Serow</i>	955
--	-------------------------	-----

The Effects of Zero Population Growth on the Spatial Distribution of Economic Activity.....	<i>George L. Brinkman</i>	964
---	---------------------------	-----

FIRST AWARD PAPER, STUDENT ESSAY CONTEST

Analysis of Potential Hedging Criteria for Live Hogs Using Seasonal Indices.....	<i>John E. Wood</i>	972
--	---------------------	-----

ABSTRACTS OF AWARD-WINNING DOCTORAL AND MASTER'S THESES		976
--	--	-----

AAEA REPORTS AND MINUTES		981
---------------------------------------	--	-----

INDEX TO VOLUME 54		1000
---------------------------------	--	------

Past Editors of the <i>American Journal of Agricultural Economics</i>		1012
---	--	------

Past Presidents of the AAEA.....		1013
----------------------------------	--	------

Social Rates of Return and Other Aspects of Agricultural Research: The Case of Cotton Research in São Paulo, Brazil*

HARRY W. AYER AND G. EDWARD SCHUH

Economic impacts of investments in cotton seed research and development in São Paulo, Brazil, are estimated. The internal rate of return to Brazilian society is estimated to have been approximately 90 percent. The effect on export earnings was large, and consumers benefited via a decrease in the price and an increase in the quantity of cotton cloth. Of total net benefits producers captured about 60 percent and consumers 40 percent. Landowners and managers received the largest share of producer benefits. Laborers benefited through an increase in employment, but wage rates were not raised. Policy implications are given.

THAT the social rates of return to investments in agricultural research could be quite high was documented and recognized in studies which preceded the dramatic evidence of the green revolution [15]. Less attention has been given to an analysis of the distribution of the benefits and costs of such programs and to the adjustments which major technological breakthroughs impose on a developing economy.¹ These issues have come to the fore in Asia, where the green revolution has had its greatest impact [7] to date.

Research [1]² on which the present paper is based had as its primary objective the evaluation of the social rates of return to cotton research in the State of São Paulo, Brazil. However, the study was also concerned with making a more general evaluation of the impact of that substantial research program on

the general economy and especially in making some evaluation of the distribution of the benefits of the new technology. In this sense, an attempt was made to extend the analysis of previous studies which restricted themselves to an evaluation of the social rates of return to agricultural research. Stimulus for the study was in part due to the fact that distributional problems are becoming increasingly important in developing countries which are making progress in strengthening their agricultural sector.

Background

Cotton has been one of Brazil's more important agricultural commodities. Roughly 10 percent of the cultivated area of Brazil has been devoted to cotton production since World War II. Cotton was fourth in importance as measured by value of production in 1959 but declined to sixth in 1966 [14, Table 39]. The cotton farmer has supplied fiber to one of Brazil's largest consumer-goods industries (textiles) and cotton exports have ranked second or third behind coffee, and occasionally cocoa, in the post-World War II period.

There are basically two cotton-producing industries in Brazil. In the Northeast a perennial tree-cotton as well as the annual varieties is grown. This cotton has a long-staple fiber and is differentiated from the annual cotton grown in the south of Brazil which has a medium-staple fiber. The State of São Paulo, a major producer of the annual cotton grown in the South, has supported a unique and rather effective research program designed to strengthen the competitive position of producers in the state. This program started in 1924 and during the 1930's was of roughly the same order of magnitude as the research program on hybrid corn in the U. S. During the latter part of the 1930's

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¹ The recent study by Schmitz and Seckler [13] is an important exception. Schultz [16] had earlier called attention to the extent to which the agricultural labor force bore the costs of technological progress and suggested means by which the burden of these costs could be at least partially redressed.

² Additional detail on the procedures used (and on the cotton industry in Brazil) can be obtained from [1] although the results presented herein differ from those in the original study. The raw data used in the study are available from the authors upon request.

HARRY W. AYER is assistant professor of agricultural economics at the University of Arizona. G. EDWARD SCHUH is professor of agricultural economics at Purdue University.

Table 1. Improvements in varieties introduced by the IAC over the varieties planted in São Paulo prior to 1930

Variety	Year Variety First Planted by Paulista Farmers	Yield				Fiber Percent		Total Increase in Fiber		Fiber Length	
		No Wilt		Med-High Wilt				No Wilt, % Increase	Med-High Wilt, % Increase	mm	% Increase
		kg/ha	% Increase	kg/ha	% Increase	%	% Increase				
Nova Paulista		1,285				32				24.6	
Russel Big Boll		1,372				32				24.4	
Express	1930	1,729	30			34	6	38		27.4	12
Texas Big Boll	1930	1,534	15			34	6	23		28.9	18
IA-7387	1935										
IA-7470						38	19	73		28.6	17
IA-21077											
IA-045											
IA-711-028	1937	1,654	25			36	12	40		29.9	22
IAC-817	1946	2,126	60			39	22	95		29.8	22
IAC-8	1957	2,009	51			38	19	80		30.8	26
IAC-9	1958	1,928	45			39	22	77		31.8	30
IAC-10	1958										
IAC-11		2,086	57			40	25	96		30.8	26
IAC-12	1960	2,057	55	647		39	22	89		31.8	30
RM-1	1962	1,929	45	1,351	228	38	19	72	283	29.1	19
IAC-RM-2	1963	2,176	64	1,294	214	38	19	95	267	30.1	23
IAC-RM-3	1965	1,945	46	1,429	247	38	19	74	305	31.8	30
IAC-RM-4	1965	1,948	47	1,370	233	39	22	79	299	31.1	27

Source: Computed from data of the IAC [10]. Further detail available from the authors.

Notes: % increase means the percentage increase in the characteristic of the improved variety over the average level of that characteristic for Nova Paulista and Russel Big Boll. Some of the varieties have been grouped together because their characteristics are the same. Information for making this grouping was obtained from Dr. Popilio A. Cavaleri, former head of the Cotton Section of the IAC.

expenditures on the program were greater than for all hybrid corn research in the U. S.³

The cotton seed research and development program has been based at the Agronomic Institute in Campinas, São Paulo (*Instituto Agrônomo de Campinas* or IAC).⁴ The basic thrust of this program was to increase yield, fiber percent, and fiber length through the development and use of improved varieties, although there was also research on cultural practices and other aspects of cotton production. In the late 1950's, for example, a major effort went into the development of wilt-resistant varieties to counter the yield-devastating cotton fungus which spread throughout much of the cotton belt at that time.

Data characterizing the consequences of the breeding program in agronomic terms are summarized in Table 1. The data refer to changes due only to varietal differences and are derived from carefully controlled test plot experiments conducted from 1924 to the present. The degree of control which the IAC main-

³ Comparison is between the research program of one state in Brazil and all public and private expenditures on hybrid corn in the U. S. As far as cotton research in the south of Brazil is concerned, this does represent practically all of the expenditures on cotton research. There were expenditures on cotton research in the Northeast, but these are not considered in the analysis, since our interest is in southern Brazil cotton.

⁴ The IAC is the agronomic research arm of the State Secretariat of Agriculture and for many years was one of the leading agricultural research centers in Latin America. Its budget support came through the state government and was financed with regular public tax revenues.

tained over the experimental process permitted the separation of yield effects due to varietal improvement, despite the fact that cultural practices in the region changed substantially over time.

As indicated in the table, the first improved varieties (Express and Texas Big Boll) were distributed in 1930. These two varieties exhibited an increase in total fiber of more than 20 percent and an increase in fiber length of more than 10 percent over the commonly planted cottons. The next group of improved varieties, IA-7387, IA-7470, and IA-21077, yielded 73 percent more fiber than the pre-1930 varieties and improved staple length by 17 percent. IAC-817, which was released in 1946, yielded 95 percent more fiber and increased staple length by 22 percent. IAC-12, first adopted by farmers in 1960, resulted in a further improvement in staple length.

One of the remarkable contributions of the breeding program was the development of varieties resistant to the wilt disease which began to sweep the region in 1957. Consequences of this disease were devastating, and infestation resulted in extremely low yields. In the short period of five years, new disease-resistant varieties were developed which enabled the region to continue production.

The magnitude of the improvement obtained with the disease-resistant varieties was, of course, quite large. Yields were more than 200 percent greater than those obtained with the pre-1930 varieties under wilt infestations. This

varietal improvement enabled the region to continue producing cotton, while in its absence, production would have probably disappeared. Combined with the increase in staple length, which also enabled cotton from the region to remain competitive in world markets, the total effect was to provide an important raw material in a fairly intensive production process while at the same time gaining an important export market.

Social Rates of Return on Investments in Cotton Research⁵

Key elements which determine the rate of return are the costs of the research, the price elasticity of supply and demand for cotton fiber from southern Brazil, and the shift in fiber supply resulting from the development and use of improved cotton varieties. Cost estimates were developed with the assistance of the IAC. Estimates of the relevant price elasticities were taken from a comprehensive econometric model of the cotton sector in Brazil estimated as part of the research. The shift factor is a combination of the increased yield of improved varieties over the unimproved ones and the adoption pattern of the new varieties. The estimation of this factor will be discussed in more detail below.

Social returns

The returns to Brazilian society from São Paulo's cotton-breeding program are illustrated in Figure 1 as the difference between the total benefits to society with the improved seed varieties (*OABC*), less the cost of production (*OAD*), and the total benefits to society with unimproved varieties (*OEFC*), less the cost of production (*OEG*).⁶ Thus, social returns = (*OABC* - *OAD*) - (*OEFC* - *OEG*).

DCFS is the total demand for cotton fiber from the south of Brazil and is dependent on

current year prices. *SCFS* is the supply of cotton fiber from the south of Brazil if improved varieties are planted, and *S'CF* is the supply of cotton fiber from the south of Brazil when unimproved cotton varieties are used. The supply of cotton fiber is postulated to depend on the previous year's price. *S'CF* is shifted *K* percent to the left of *SCFS*, where *K* is determined by the difference in fiber yield between the old and improved varieties and the proportion of each new variety planted.

The demand equation (*DCFS*) can be represented on an annual basis by collapsing the estimated demand equation into two dimensions defined by the price (*PCFS*) and quantity (*QCFS*) of southern Brazil cotton fiber. That is,

$$(1) \quad DCFS: \quad PCFS = n \overline{QCFS}^{-.188}$$

where *n* includes all parameters and variables influencing demand but excluded from the equation. By substituting the observed annual quantity (*A* from Figure 1) and price (*P₂*) into equation (1), *n* may be estimated directly and equation (1) defined annually as *n* varies from year to year.

The same procedure is employed to compute a two-dimensional supply equation for cotton fiber from southern Brazil on an annual basis. Thus,

$$(2) \quad SCFS: \quad QCFS = m(\overline{PCFS}_{t-1})^{.944}$$

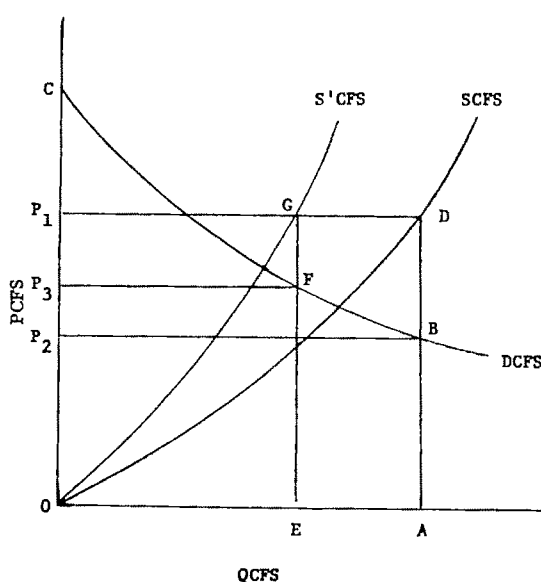


Figure 1. Social returns due to supply shift

⁵ The basic framework for this analysis is the same as that used by Griliches [8] and Peterson [12], although closer to Peterson's, since we assume a positively sloped supply function for the main analysis. The approach is based on the concepts of consumer and producer surplus, both of which have a controversial history. For a recent balanced review of the evolution of these concepts and their use in economic analysis, see [4].

⁶ This formulation differs from Griliches' [8] and Peterson's [12] formulations since a recursive cobweb model was postulated for the cotton sector vs. their more static model formulations.

where $QCFS$ is the quantity of cotton fiber from southern Brazil, \overline{PCFS}_{t-1} is the price of cotton fiber from the south of Brazil in the previous time period, and m represents the remaining parameters and their corresponding variables which influence supply. The parameter m (and therefore the supply equation) is computed on an annual basis by substituting the observed quantity (A) and previous year's price (P_1) into equation (2) for each year and solving for m .

K depends on changes in both yield and fiber percent and on the distribution of varieties. For any particular year,

$$K = \sum_{a=1}^x \left[\left(1 - \frac{Y_u F_u}{Y_a F_a} \right) \cdot Pa \right] \cdot 100$$

where:

Y_a = yield of the new variety "a" (Table 1)

Y_u = average yield of the unimproved varieties Nova Paulista and Russel Big Boll = 1329 kg/ha (Table 1)

F_a = fiber percent of the new variety "a" (Table 1)

F_u = average fiber percent of the unimproved varieties Nova Paulista and Russel Big Boll = 32 percent (Table 1)

Pa = the percentage of variety "a" distributed [1, p. 42]

x = the number of varieties distributed in any particular year [1, p. 42].

Averages of the estimates of K for selected years are given in Table 2.

$S'CFS$ equals $(1-K) \cdot SCFS$. That is,

$$(3) S'CFS: QCFS = (1-K)m(\overline{PCFS}_{t-1})^{.944}$$

where K , m , and \overline{PCFS}_{t-1} vary from year to year. Once equations (1), (2), and (3) have been estimated for each of the years 1931 to 1967, the annual social returns may be determined by solving equation (4):

$$(4) \quad \text{Social returns} = \int_0^A (DCFS)d(QCFS) - \int_0^A (SCFS)d(QCFS) - \int_0^B (DCFS)d(QCFS) + \int_0^B (S'CFS)d(QCFS).$$

Averages for the annual social returns in selected years are given in Table 2, together with data on the estimated annual costs of São Paulo's cotton seed research and development program.

Two important points should be noted about the costs and returns. First, research costs began several years before returns were realized. Second, after improved varieties were first adopted, the flow of returns was always several times larger than the flow of the annual costs of the breeding program.

Internal rate of return

The social returns may be compared with the costs of the breeding program by computing the internal rate of return. The internal rate of return is defined as that rate (r) which results in the following equality:

$$(5) \quad \sum_{t=1}^f R_t(1+r)^{-t} = \sum_{t=1}^f C_t(1+r)^{-t}$$

where:

R_t = the estimated social returns in year t

C_t = the estimated costs of research and development in year t

r = the internal rate of return

t = year (year 1924 is 1)

f = the year costs and returns end, here assumed to be year 62 (i.e., 1985).

Expenditures on seed improvement research are assumed to terminate in 1966, with the only continuing expenditures being the costs of processing, distributing, and maintaining the superiority of the improved varieties. These costs are estimated to be 50 percent of the

Table 2. Estimate of K , costs, and the social returns associated with São Paulo's cotton seed research and development program, annual averages, 1924-67

Years	K , Percent	NCr \$, 1939 Prices	
		Costs	Returns
1924-1930	0%	NCr \$ 858	NCr \$ 0
1931-1935	23	5,106	38,950
1936-1945	37	10,087	210,692
1946-1955	44	13,146	259,774
1956-1966	49	12,355	334,574
1967	53	*	261,532

* Data not available.

Source: Computations described in text.

total expenditures in 1966.⁷ Likewise, no seed improvements are assumed to occur after 1967, with annual future returns from varieties then in use arbitrarily set at *NCr* \$250,000. This figure is just below the estimated returns in 1967 and considerably below the 1960-1967 average. To be on the conservative side, all costs and benefits are arbitrarily ended in 1985 (62 years after the breeding program began).

Based on these assumptions, the internal rate of return is calculated to be 89 percent. This appears to be a very high return on investment, especially considering that the estimates of costs were biased upward wherever a choice was involved and the estimates of returns were biased downward wherever possible.

Sensitivity analysis

Different assumptions about the supply and demand elasticities and about the shift factor *K* will result in different estimates of the internal rate of return. The 89 percent rate obtained above was based on an elasticity of demand of -5.3 , an elasticity of supply of $.944$, and estimates of *K* as described above. Each of these basic parameters might be questioned. For example, it seems plausible to argue that the price elasticity of demand for cotton fiber should be infinite, rather than the estimate of -5.3 obtained from the econometric model, since Brazil can always sell on the export market where it is relatively unimportant. The estimate of -5.3 , which of course is elastic, was used because it was based on empirical evidence (albeit from statistical results that were not particularly strong) and because the probable effect of restrictions by the Brazilian government on cotton exports (see below) was to make the demand elasticity something less than infinite. The skeptic, however, could argue that the econometric results are spurious.

Similarly, an alternate estimate of the elasticity of supply for cotton fiber, which was based on a longer series of data, was only about half that used in the above calculations ($.449$

compared to $.944$). Given that the returns from the research program were accruing over this longer period of time, it might be argued that the lower supply elasticity is more appropriate for calculating the social rate of return. To test the sensitivity of the results to this elasticity, estimates were made with the supply estimates set equal to both zero and 1.5 .

The results revealed that the internal rate of return is rather insensitive to different assumptions about the respective price elasticities (Table 3). Assuming a perfectly elastic demand curve, the rate of return is lowered but by only two percentage points (from 89 percent to 87 percent, with the supply elasticity held unchanged).

Changes in the supply elasticity have a somewhat greater effect, but even here the difference is small. The assumption of zero elasticity of supply results in a larger rate of return, compared to assumptions of positive values. If anything, then, the estimate of 89 percent is biased downward, since the larger of the two supply elasticities at hand was used in calculating it.

Hence, even under the "severe" assumptions of a perfectly elastic demand equation and a supply equation with an elasticity of 1.5 , the internal rate of return was 80 percent. This is still a high rate of return by most standards.

Finally, it could be argued that estimates of *K*, the supply shifter, are subject to error. Thus, the internal rate of return was recomputed with *K* assumed to be 10 percent less and then 10 percent greater than the original estimates. The internal rate of return is again

Table 3. Estimated internal rates of return (percent) under various assumptions concerning elasticity of supply and demand and the shift factor *K*

Elasticities	<i>K</i>		
	<i>K</i> nominal	<i>K</i> nominal -10%	<i>K</i> nominal +10%
$E_s = .944$ $E_d = -5.3$	89%	86%	92%
$E_s = .944$ $E_d = \infty$	87%	84%	90%
$E_s = 0$ $E_d = \infty$	107%	104%	110%
$E_s = 1.5$ $E_d = \infty$	80%	77%	82%

Source: Computations described in text.

⁷ The ratio of the budget requests of the Section for Examining and Distributing Cotton Seed (SEDCS) to the total budget requests of all cotton research and development sections was 35 percent [1, Chapter V and Appendix H]. The SEDCS supervises the multiplication of the seed on the *Campos dos Cooperadores* and is responsible for maintaining the genetic purity of the seeds distributed. We use 50 percent in order to include these costs plus 15 percent more to cover costs of maintaining the yield advantage as new insects and diseases disrupt cotton production.

rather insensitive and the rate r varies by only about 3 percentage points from that calculated with K nominal.

Estimates under these various assumptions indicate that the internal rate of return to investments in cotton seed research and development has been very high. Even under the most unfavorable assumptions the internal rate of return was 77 percent.

These estimates may be compared with those obtained in other studies of a similar nature. Griliches [8] estimated the internal rate of return to investments in hybrid seed corn research in the United States to be about 35 to 40 percent,⁸ while Peterson [12] estimated the internal rate of return to U. S. investments in poultry research to be about 20 to 30 percent. In a somewhat broader context, Evenson [6] found general public and private agricultural research and extension investments in the U. S. to have yielded an internal rate of return of about 45 to 55 percent.⁹ In terms of these comparisons, São Paulo's cotton seed research and development program has paid off handsomely.

Effects of the Research Program on Export Earnings and on the Price and Utilization of Cotton Cloth

One goal of the research reported herein was to trace in some detail the more general impact of the research program on the Brazilian economy. The econometric model provides a means of implementing this analysis.

Effect on export earnings

An important benefit of São Paulo's research program on cotton seems to have been a strengthening of its world market position in the crop and a substantial increase in export earnings. A rough estimate of the effect of the breeding program on exports may be made by estimating domestic utilization of cotton during a recent period of time and comparing this with an estimate of what cotton fiber production would have been if new varieties had not been available. If production would have been less than domestic utilization, then any exports of cotton fiber which *actually did* occur may be

⁸ His estimated internal rate of return of 35 to 40 percent corresponds to the more frequently quoted external rate of return of 700 percent.

⁹ Evenson's estimates are marginal rates of returns while the others, including ours, are average rates.

attributed to the new varieties having replaced the unimproved ones.

The analysis is based on data for the 13-year period of 1955 to 1967 since prior to this period, and especially during the war years and the years immediately following, stocks and exports often fluctuated violently. Average production of southern Brazil cotton fiber from 1955 to 1967 was 343 thousand tons. Average exports of southern Brazil cotton fiber for this period were 123 thousand tons. Therefore, average domestic utilization was 343 minus 123 or 220 thousand tons.

The average production of cotton fiber which would have been obtained had old instead of improved varieties been planted may be estimated from the above calculations of average production and the productivity factor K described in the previous section. K is the percentage decrease in cotton fiber production which would result if old varieties replaced the improved ones. Production with the less favorable seed would be $(1-K)$ times the production actually obtained using the improved seed. K averaged .49 for the 13-year period and $1-K$ equals .51. Average production using the poor varieties would, therefore, have been approximately 175 thousand tons ($.51 \times 343,000$ tons).

Production of 175 thousand tons would not have satisfied the estimated domestic utilization of 220 thousand tons,¹⁰ and the implication is that Brazil would have become a net importer of cotton. Alternatively, the conclusion which follows is that the cotton fiber exports from southern Brazil which actually did occur from 1955 to 1967 may be attributed in large part to the use of improved cotton seed varieties.

This conclusion is supported by other evidence. Cotton fiber exports from the south of Brazil have also been influenced by the effects of the cotton-breeding program on fiber length.

¹⁰ Of course, the failure of the supply curve to shift to the right as fast as it actually did could lead to higher prices. This could be expected to call forth some additional production from shifts along the supply curve and could also reduce the quantity demanded. However, the domestic demand for cotton fiber is probably rather inelastic, and the quantity demanded would not change in proportion to the price change. This proposition is supported by our estimate of an inelastic demand for cotton cloth and Blakley's [3] estimate of an inelastic consumption response to changes in cotton fiber price in the U. S. The supply elasticity is relatively small also.

Prior to 1930 most of São Paulo's cotton was classified in the 24/26 mm class or shorter. Such a short staple is not acceptable on the international market for at least two reasons. First, consumer demand favors a finer, stronger cloth than can be manufactured from such a short fiber. Second, the technology of cotton spinning and weaving machinery makes the longer staple cheaper to process. Because of these market conditions, an increase in fiber length over that of the unimproved varieties has been practically a necessary condition for the export of cotton from southern Brazil.

It should be noted that the contribution of the research program in this regard is fairly substantial. Brazilian exports of cotton have been an important source of foreign exchange earnings, with cotton second only to coffee in most years since 1934. Between 1936 and 1967 cotton fiber exports from São Paulo averaged more than 80 percent of Brazil's total cotton exports. On the average São Paulo's cotton exports comprised more than 8 percent of Brazil's total export earnings from 1934 to 1967.

Effects on the price and quantity of cotton cloth

The Brazilian consumer may enjoy a larger quantity of cotton cloth at a lower price because of the research-induced shift in the supply schedule for southern Brazil cotton fiber. Whether or not the consumer receives the benefits directly depends on the elasticity of the total demand for cotton fiber. If it is infinitely elastic, as might be hypothesized since Brazil is relatively unimportant in the world market, then there would not be a decrease in fiber prices due to a shift in fiber supply. Consequently, neither the price of manufacturing cotton cloth nor the retail price of cloth would be affected. However, if the total demand for cotton fiber is not infinitely elastic, then there would be a price effect resulting from a shift in fiber supply, and the cost of manufacturing cotton cloth would decline, with a subsequent decrease in the price of cotton cloth to the consumer.

The effective total demand (by millers, exporters, and stockers) may not be infinitely elastic because of government policies which restricted cotton fiber exports. From 1958 through 1967 the Brazilian government limited cotton fiber exports directly through a system of export licenses which were applied in an attempt to ensure an adequate supply of cotton

fiber to the domestic market at a "reasonable" price.¹¹ Presumably, the estimated elasticity of demand of -5.3 which was obtained in the econometric work reflects the effects of these policies.

Given a demand which is not infinitely elastic, a shift in fiber supply resulting from the use of improved seeds will decrease the domestic price of cotton fiber, other things being equal, and this price decrease should be reflected as a shift in the supply schedule for cotton cloth. The statistical estimates of the supply and demand schedules are used to estimate these price and quantity changes.

The estimated demand for cotton cloth (*DCCB*) reduced to two dimensions is

$$(6) \quad DCCB: \quad QCCB = s PCCB^{-0.74}$$

where *QCCB* and *PCCB* are the quantity and price of cotton cloth in Brazil, respectively, and *s* accounts for the remaining variables and their corresponding parameters. Since the quantity and price are observable, *s* may be estimated directly for each year from 1931 to 1967.

The supply of cotton cloth (*SCCB*) is estimated to be

$$(7) \quad SCCB: \quad QCCB = t PCCB^{2.360} PCFS^{-1.129}$$

$$(8) \quad = v PCCB^{2.360}$$

where *QCCB* and *PCCB* are the same as for equation (6), *PCFS* is the price of cotton fiber from southern Brazil, and *t* and *v* account for the suppressed parameters and variables. Again the constant term *v* may be estimated for any particular year by substituting the observed price and quantity into equation (8) and solving for *v*.

The shifted supply schedule for cotton cloth (*S'CCB*) is estimated to be

$$(9) \quad S'CCB: \quad QCCB = [1 + (1.129 \times q)] \cdot v (PCCB)^{2.360}$$

where 1.129 is the elasticity of cloth supply with respect to the price of southern Brazil cotton fiber [from equation (7)] and *q* is the percentage change in the price of fiber if new

¹¹ An evaluation of this policy may be found in a recent paper by Ayer and Schuh [2]. We note in passing that the analysis of the paper suggests that each *cruselo* of consumer surplus was obtained at the expense of 2.5 *cruselos* of sacrificed export earnings.

Table 4. Percentage changes in the price and quantity of cotton cloth associated with São Paulo's cotton seed research and development program, annual averages, 1931-1967

Years	Annual Average Percentage Decrease in the Price of Cotton Cloth	Annual Average Percentage Increase in the Quantity of Cotton Cloth
1931-1935	2.4 %	.2 %
1936-1945	4.3	.3
1946-1955	5.5	.4
1956-1967	6.6	.5

Source: Computations described in text.

varieties were replaced by unimproved varieties. The coefficient q is computed by solving the demand equation for cotton fiber (1) for the price which would result if unimproved varieties had been used (P_1 in Figure 1) and by calculating the percentage change from observed price P_2 .

Given the demand schedule for cotton cloth ($DCCB$) and the supply schedule ($S'CCB$), the equilibrium price and quantity may be computed by solving equations (6) and (9) simultaneously for each year from 1931 to 1967. The differences between these equilibrium prices and quantities and the observed prices and quantities are then calculated and expressed as a percentage decrease in price and a percentage increase in quantity resulting from the use of improved varieties instead of unimproved varieties. The average percentage changes in price and quantity for selected intervals are shown in Table 4.

The estimated percentage decrease in the price of cotton cloth resulting from the use of new varieties ranged from 2.4 percent in 1931 to 7.7 percent in 1965. This is accompanied by a general increase in the consumption of cotton cloth, although the percentage change is very small, in accord with the low price elasticity of demand.

The average percentage change in the price of cotton cloth over the entire period 1931 to 1967 is 5.1 percent. Such a decrease in real terms is fairly large. In a country where the level of income is low and a sizable fraction of the family budget goes for clothing, the income gains from such a price decline can be important.

Distribution of Benefits

Distribution of the benefits resulting from the cotton-breeding program of São Paulo is analyzed in this section. The analysis considers the distribution between producers and consumers, the distribution of producer benefits among the factors of production, and the effect of the new seed technology on labor adjustment problems.

Distribution of benefits between producers and consumers

Distribution of social benefits resulting from São Paulo's investment in cotton seed research may be realized by producers, consumers, or both. Here the portion going to producers is defined as the difference in producer surplus using improved varieties vs. unimproved varieties. From Figure 1 this change in producer surplus is represented by $(OABP_2 - OAD) - (OEFP_1 - OEG)$. The change in consumer surplus is $P_2BC - P_1FC$ or P_2BFP_1 . Estimates of these areas are based on a price elasticity of demand of -5.3 and supply of $.944$. The same procedure of collapsing the equations into two dimensions, price and quantity, as described in an earlier section, is used to obtain annual estimates of the areas.

The results show that the producers have realized the largest share of the social gains from cotton seed research. On the average about 60 percent of total social gains have gone to the producer in the form of producer surpluses and about 40 percent to the consumer as consumer surpluses. This division, of course, reflects the relative price elasticities of demand and supply.

Earlier discussion indicated that between 1958 and 1967 the government pursued a policy which limited exports of cotton fiber in an attempt to assure a cheap supply of cotton fiber for Brazil's textile mills. Therefore, in a sense, this analysis represents an *average* effect over the entire time span of analysis, since the demand equation was estimated with data covering the period 1936 to 1966. In some parts of this period there were no export restrictions. The less-than-infinite elasticity obtained for the demand equation is probably reflecting the restrictions of the more recent time period. If the elasticity of demand were in fact perfectly elastic, then the first-order effects of the technical change would be distributed entirely to

the producer and none would be received by the consumer.¹²

Distribution of the producer benefits among the factors of production

In evaluating a development policy such as the production and distribution of new technology, it is useful to know the impact of the program on resource returns and resource utilization. Changes in these elements will depend on shifts in the demand for the individual factors which result from the new technology and on the elasticity of supply of the individual inputs. In the following analysis attention is centered on land and labor because they are the two most important inputs in cotton production,¹³ and because it is somewhat easier to make inferences about what has happened in their respective markets.

The immediate effect of the new production technology was to shift upward the production function which describes the relationship between the conventional inputs (land, labor, and capital) and output. In physical terms this represents an increase in the demand for inputs, although the relative effect on individual inputs is not known. This would require more specific knowledge on the specific resource-using effects of the technology, which is unavailable. Use of improved varieties, however, would appear to increase the productivity of all conventional inputs.

The upward shift of the production function is very likely translated into rightward shifts in the demand for inputs. Given the export potential for the product, the demand elasticity is high. Hence, price declines as a result of the output increases are likely to be minimal and not sufficient to outweigh the effects of the increase in productivity.¹⁴

The effect of the shift in demand for inputs on factor returns and resource utilization, then, depends on the relative elasticities of supply of the inputs. Consider land, for example. Al-

though Brazil has an abundant supply of land, not all of it is suited to the production of cotton. Ecological conditions under which it can be grown are rather limited. This leads to an hypothesis that the amount of land for cotton is rather inelastic in supply but not perfectly inelastic.¹⁵ This hypothesis is supported by a recent empirical study [18] which estimated the elasticity of cotton acreage in São Paulo, with respect to the price of cotton, to be .37.

This suggests that an important part of the producer benefits has been capitalized into higher land values, although part of the increase in demand has also been translated into increases in the area planted to cotton.¹⁶ Unfortunately, no continuous series of land values are available to verify this proposition.

Entrepreneurial talent for the production of cotton is also limited and probably relatively inelastic in supply, at least in the short run. Proper cultivation of cotton requires a rather exacting knowledge of when to plant and cultivate, row spacing, plant density, and cultural practices such as fertilization and disease and insect control. Although the extension service attempts to lower the cost of acquiring this knowledge and to supply substitute entrepreneurial skills, the supply of entrepreneurial talent in the aggregate for cotton production is still very likely to be relatively inelastic. This suggests that part of the producer benefits has been realized as an economic rent to scarce entrepreneurial talent. Since an im-

¹² A precise evaluation of the elasticity is difficult for a number of reasons. First, cotton production in the south of Brazil has been concentrated in the states of São Paulo and Paraná, even though climatic conditions for its production appear to be better in the southern parts of Goiás and Mato Grosso and in northern Minas Gerais. The presence of these other large areas where cotton could be grown suggests that the supply of land for cotton production is relatively elastic. However, for reasons not completely clear to the authors, cotton production did not move into these other areas on a substantial scale until recent years, even though the seeds developed in São Paulo are adaptable in the other regions. The failure of cotton to move to these other regions may be in part a result of an inadequate market infrastructure for both inputs and the product. If that is the case, these regions were for all practical purposes not part of the cotton economy, and the supply of land suited to cotton production was indeed limited.

¹³ As the new frontier areas of the Central West are brought into the market economy, the supply elasticity of land for cotton production will probably increase, with the result that a smaller fraction of such gains will be translated into higher land values in the future.

¹⁴ If the increased export earnings that result from the increased output were used to obtain a more rapid rate of economic development, the consumer, of course, would benefit in this second-order way.

¹⁵ Land and labor have generally accounted for well over 60 percent of total input costs in the production of cotton in the south of Brazil [11, 17].

¹⁶ For a rather careful analysis of the relative effect of productivity changes and market effects in the U. S. agricultural labor market see [19].

portant share of cotton in the South is produced by owner-operators, the landlord gains both as an owner of the land and as an owner of the scarce entrepreneurial talent.

The supply of labor, on the other hand, is relatively elastic. Two pieces of evidence support this proposition. First, there has been a pronounced migration of people from the east and northeast of Brazil to the South for several decades [14, Ch. II]. A large share of these migrants has gone to the agricultural sector of the South, at least as an initial stopping place.¹⁷

That the cotton sector has faced a virtually perfectly elastic supply curve of labor is reflected in data on wage rates of cotton harvesters in São Paulo. Real wage rates have risen for short periods of time, such as in the early 1950's and in the mid-1960's. However, they appear to return to the same level after adjustment takes place. Moreover, the increase in the mid-1960's was due primarily to the extension of the minimum wage to agriculture. Since the real value of this institutional wage has been permitted to decline, wages paid to workers have since declined to their previous level.

Hence, the spread of the new technology probably led to increases in the level of employment but was not reflected in higher real wages for workers. The increase in employment is a positive gain, contrasting sharply with the adoption of other kinds of technology such as mechanization which might well have created unemployment. Given the seriousness of the employment problem in Brazil [14, Ch. II], application of biological-technical research to an export crop—and one that is relatively labor-intensive—appears to have been a wise technological choice. Moreover, it should be noted that some portions of the effects of the technical change are transmitted to other parts of Brazil through the labor market.

The qualitative-quantitative analysis in this section suggests that the bulk of the benefits of the new technology were realized, at least as first-order effects, as a producer surplus. An important part of the benefits channeled to consumers was done so by government restrictions

on exports. On the production side the benefits went to landowners in the form of capital gains and to the owners of relatively scarce entrepreneurial skills, who received an economic rent in the form of higher incomes. The labor force benefited from the creation of additional employment, but because of conditions in the labor market, very little of the benefits of the new technology in raising productivity appears to have been realized in the form of higher real wages.¹⁸

Discussion and Some Implications

São Paulo's investments in cotton seed research and development, which were sizable by almost any standard, resulted in substantial increases in cotton yields, fiber percentage, and fiber length. The new varieties increased total fiber productivity (a combination of cotton yield and fiber percent) by 23 to 305 percent, depending on the variety and on whether or not the wilt disease was present. The social rate of return to these investments was quite high, the estimated internal rate of return being about 90 percent. The research and development program appears to be largely responsible for Brazil's sizable exports of cotton in recent decades while at the same time being responsible for a small decline in the price of cotton and cotton cloth. Benefits of the technical change resulting from the research program appear to have gone in large part to the producer and appear to have been realized as increases in land values and economic rents to scarce entrepreneurial talent. The labor force gained by the creation of new jobs, but the new technology did not appear to lead to increases in real wages to labor.

These findings suggest a series of questions. An attempt at answering these questions is one means of drawing out some of the major implications of the research.

1. *Why did São Paulo invest so heavily in cotton research and so sparingly on other products such as the food crops?*

The answer to this question has to be speculative, but one hypothesis is that the explanation lies in the distribution of the benefits. At the time relatively large investments were made the state legislature was in the hands of rural landowners and farmers. It seems plausible that these landowners saw the potential of cotton as

¹⁷ The migratory process is actually rather complicated. An almost continuous flow of migrants from the Northeast has been entering the South over a long period of time. At the same time, however, there has been a net outflow from the rural areas of São Paulo to urban centers. The net result of this rather large "churning" of the labor force in recent years has been a sizable net absolute decline in the agricultural labor force in the State of São Paulo.

¹⁸ Workers probably did benefit from the decline in the real price of cotton cloth.

an export crop and recognized that the benefits of technical change would be realized as a producer surplus, as contrasted to a consumer surplus with domestic food crops.^{19,20} In this case is a clear example of the dialectical interaction between producers, or the body politic, and researchers, which Hayami and Ruttan [9] have stressed.

Recent history supports this hypothesis in a negative way. Rural landowners no longer control the political process in São Paulo. Support for agricultural research, even for cotton research, in the state is declining, and one of the reasons may well be the breaking of the dialectical interaction between the beneficiaries of the research and the decision-making process on the state budget.

2. Why was the rate of return so high?

The internal rate of return on cotton research in Brazil was found to be much higher than that obtained in most other studies of successful research programs. There seems to be a number of reasons for this. First, the yield increases were indeed substantial. Total fiber productivity increased as much as 75 percent over traditional varieties. One factor which explains these large increases is the presence of the wilt disease, which threatened to wipe out cotton production in Brazil. Development of disease-resistant varieties makes the yield comparison very great and demonstrates the value of research programs which can annul such cataclysmic events.

A second factor which explains the high rate of return is the multipronged nature of the research program, which emphasized improving the quality of the cotton as well as the physical yields. Both the fiber percentage and the fiber length were improved, making the crop more competitive in world markets.

Third, institutional arrangements were devised which accelerated the adoption of the new varieties once they were produced. The State Secretariat of Agriculture was given a seed

monopoly, and the producer was required to purchase his seed from that source. The result of this institutional arrangement was that new varieties were adopted almost immediately after the researchers had declared the new varieties suitable and a sufficient supply of seed could be produced.

In addition, the state made very effective use of "cooperation" fields (*campos de cooperação*), a unique program which probably resulted in a more convincing demonstration of new production technology than usually obtained with demonstration fields. The government contracted with individual producers to produce seed for the government. Producers received a higher price for their product than that paid in the market, but as a *quid pro quo* they were obliged to produce the cotton under the technical orientation of the extension service. This provided a means of demonstrating on a widely dispersed basis the latest in production technology and increased the probability that the new seed was grown with the appropriate practices. Moreover, the farmers themselves were doing it.

Finally, the high rates of return may be an artifact of the analytical framework used for the analysis. For the most part, the analysis was cast in a partial-equilibrium frame of reference. This may have resulted in an under- or overestimate of social returns, depending on the conditions of factor supplies and the extent to which the product supply curve reflects the opportunity costs of the resources involved.

3. Was there a regional effect associated with the program?

The answer appears to be yes, although the location specificity of the new technology does not appear to have been all that great. The interesting point is that the efficacy of the research program appears to have retained the production of cotton in the state despite the fact that the region does not have a natural comparative advantage in terms of ecological conditions. To the contrary, specialists argue that the cotton-producing region of São Paulo and Paraná is on the southern limit of suitable climatic conditions and in this sense is a marginal area. Moreover, abundant areas with more desirable natural conditions exist further to the north.

It seems entirely possible that in the absence of the research program the production of cotton would have spread to the North at a much

¹⁹ Additional political support may have been provided by the growing industrial sector which rightly saw the need for cheap raw materials. The fact that an important part of the entrepreneurial talent and capital for the industrial sector came from agriculture [5] probably reinforced this tendency.

²⁰ Rubens Dias and Ruy Paiva, two Brazilian students of the Paulista agricultural economy, disagree at least in part with our hypothesis. They argue that resources were allocated to the cotton program largely on the strength of the dynamic personality of the man who headed the program.

earlier date. The rise in domestic prices which would have resulted in the absence of the new production technology would have overcome the transportation costs of the larger distance to market and stimulated development of an adequate marketing infrastructure at an earlier date. In this sense, one of the benefits of the research program was to maintain the comparative advantage of the areas further south, despite their less suitable endowment of natural resources. In other words, cotton production in southern Brazil has been based on technology, not on natural resources.

4. *Is there a place for research on export crops?*

The answer to this question seems to be a qualified "yes." It of course depends on the circumstances, but it would appear that there is a tendency to down-play research on export crops in favor of products for domestic consumption. There seems to be at least two reasons for this. First, in the more distant past most of the research programs in LDC's were associated with export crops and financed largely by colonial powers. The enclave nature of these programs and their tendency to benefit primarily the colonial powers caused them to be discredited, especially during the period when low-income countries turned inward with import-substitution-industrialization programs. Second, the food production-population scare of the mid-1960's caused international agencies to become more concerned about the production of food and less concerned about agricultural development in a somewhat larger context.

Although the food-population race is by no means won in all countries, it does seem appropriate at this time to take a somewhat broader perspective. Employment problems are serious in most low-income countries and with rapid population growth, they promise to become more serious. Technical research directed toward food products alone does not appear to offer much of a solution to this problem, despite its contribution to lowering the real price of

wage goods. As long as the demand curve for an agricultural product is inelastic, the market effects of output increases are likely to outweigh the productivity effect, the net result being that agricultural employment will decline [19].

Clearly, not all producing countries of a given product are likely to increase their exports as a result of a research effort. Investments in agricultural research need to be evaluated in the context of the overall development strategy of the country, and investments in research for export products need not be avoided because of a world concern for the food problem. Put somewhat differently, if the goal is economic development defined as an increase in per capita incomes and increased employment opportunities, an individual country can gain a great deal from research on export products. In the case of Brazil, substantial increases in foreign exchange earnings appear to have resulted from such a program, and the negative employment effects associated with research on products with more limited markets were avoided. These were substantial positive gains in the face of other distributional effects of the new technology that were not so desirable.

Some Concluding Comments

An important objective of the present research was to analyze in some detail the distributional effects of a new production technology. This analysis was limited by the lack of precise information on the resource-saving (or -using) effects of the new technology and by the lack of knowledge of the structural parameters of the factor supply curves. In this sense some of the propositions set forth about the beneficiaries of the new technology are more in the way of hypotheses subject to further testing than hard empirical generalizations. However, this line of analysis appears to be especially fruitful as a basis for developing a more adequate research and development strategy for low-income countries.

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American Agriculture and the Prophecy of Increasing Misery*

THEODORE P. LIANOS AND QUIRINO PARIS

A Marxian analysis of labor exploitation in American agriculture has indicated that the rate of exploitation has increased more than seven times from 1949 to 1968. Exploitation is defined in a relative sense as a declining of the income share of workers relative to that of capitalists. Labor is defined to include both hired and family workers. While exploitation of hired labor may appear as a familiar notion, the idea is advanced that family labor may have been exploited also.

RAPID changes, such as introduction of new technology, increasing degree of mechanization, and increasing farm size have characterized the American agricultural sector in the post-war period. The most dramatic development in terms of its implications and the least noticed in terms of the amount of research devoted to its study, however, is undoubtedly the change in the share of labor. Of course, the change in the relative share of labor is not independent of the other structural changes, and, in fact, it will be shown in this paper to be a direct result of the interaction of the forces underlying the capitalistic mode of production.

The relative share of labor has decreased from 72 percent in 1949 to 33 percent in 1968. This sharp decline within a period of 20 years is astonishing, particularly in view of the fact that recent research [10] has shown a relatively constant share of labor in the American non-farm sector for the post-war period up to 1960. The divergence in the behavior of labor's relative share in these two sectors may be interpreted as reflecting a considerable degree of isolation of the agricultural sector from the rest of the economy. Generally speaking, two or more sectors can be integrated into an economic system if no barriers exist in the mobility of commodities and/or factors of production in the respective markets. It is a well-established fact that the absorption of agricultural commodities is limited by low income and price elasticities, and therefore, the burden of adjustment of the changes occurring in agricultural production falls on the factor markets. For the particular period under examination, 1949-1968, which

has been characterized by an increasing capital-labor ratio, adjustment to the introduction of new technology has come through the labor market. However, numerous impediments to geographic and occupational mobility of agricultural labor, such as lack of information, transportation costs, and lack of preparedness of farm labor for industrial employment, have prevented the integration of the agricultural sector with the rest of the economy.

An investigation of the sources of change in the relative share of labor within the framework of neoclassical theory of production has been recently conducted and reported [4] by one of the authors. In this paper the same phenomenon is explored and analyzed in terms of a theory with entirely different philosophical foundations, namely, the Marxian theory of exploitation. The motivation to employ Marx's theory of exploitation derives from three considerations. First is the belief that balance in intellectual diet is healthy. Second, given the recent development of radical economics [1], this approach may be viewed as an attempt to introduce scientific radicalism into the traditional field of agricultural economics. Third is the desire to determine whether the development in American agriculture may be taken as a realization of Marx's prophecy of increasing misery.

As stated later in this paper, the concept of increasing misery is used in a relative sense, namely, misery is increasing if the labor share is decreasing in relation to total income, even though it may be increasing absolutely and even if the wage rate is increasing. The behavior of labor's relative share and its explanation occupy the entire paper.

In this paragraph some information is presented which is suggestive of the magnitude of the misery of farm laborers individually and in an absolute sense. This information is contained in Table 1. The table is largely self-explanatory, but some brief comments are made to point out the implications. Column (1) shows that the

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Table 1. Employment, earnings, and relative share of labor, U. S. agriculture, 1949-1968

Years	Average yearly employment (ths. of men)	Hours per year per man	Average annual farm earnings in dollars per man	Neoclassical estimate of labor's relative share $S_L = \frac{W \cdot L}{VA}$	Marxian estimate of labor's relative share S_L'
	(1)	(2)	(3)	(4)	(5)
1949	9,964	1626	1286	.7223	.874
1950	9,926	1525	1196	.6787	.924
1951	9,546	1593	1254	.7337	1.075
1952	9,149	1579	1304	.7036	.971
1953	8,864	1565	1351	.6652	.875
1954	8,651	1539	1313	.6131	.824
1955	8,381	1528	1332	.5783	.773
1956	7,852	1531	1386	.5451	.724
1957	7,600	1435	1307	.5147	.702
1958	7,503	1406	1294	.4754	.680
1959	7,342	1403	1306	.4601	.643
1960	7,118	1401	1332	.4361	.597
1961	6,990	1345	1293	.4102	.559
1962	6,700	1340	1289	.3909	.543
1963	6,518	1329	1304	.3712	.504
1964	6,110	1341	1342	.3733	.508
1965	5,610	1386	1436	.3441	.473
1966	5,214	1416	1528	.3420	.487
1967	4,903	1483	1699	.3323	.470
1968	4,745	1476	1756	.3337	.481
Mean				.501	.684

Sources: [13] and [14].

level for employment in U. S. agriculture has been reduced more than half over the 1949-1968 period. The implication is that employment opportunities in the nonfarm sector must be available if the displaced farm workers are to be employed. This has not been possible throughout the 1949-1968 period, particularly during the periods of general economic recession. Displaced farm workers who remain unemployed experience an absolute increase in misery. Higher wages will not help them if jobs are not available. Of course, it is recognized that not all the reduction in yearly employment represents displaced workers. Other reasons, such as farmers' retirements and occupational shifts, may partly account for the farm employment decline. Column (2) refers to workers who remained employed in the farm sector. It shows that the number of hours they worked in each year declined until 1963 after which there was a minor increase. Column (3) shows that the average annual earnings per worker (calculated by multiplying column two by the corresponding composite wage rate) had been fluctuating around \$1300 with no obvious tendency up until 1965.

Behavior of the Relative Share of Labor

Labor's relative share (S_L) is defined as the proportion of total income received by labor,

that is, $S_L = W \cdot L / VA$, where W = wage rate, L = amount of labor measured in man-hours used in production, and VA = total net income generated in the agricultural sector (value added). For estimation of S_L the wage rate was measured by the composite rate per hour as reported in [14]. The labor input was measured by the number of man-hours as reported in [13]. This measure consists of labor required for all farm work and includes hired farm workers, farm operators, and unpaid family workers. This measure of the labor input implies that in estimating the wage bill ($W \cdot L$) the tacit assumption is made that farm operators and unpaid family workers receive the same wage rate as hired workers. Given the available data, this procedure is necessary. Furthermore, it will be argued later in this paper that it is not impossible for farm operators to exploit their own labor and that of their family. For some minor problems arising from this procedure of imputing wages to nonhired workers the reader is referred to [9, p. 61]. Value added was measured by the following expression: VA = (cash receipts from farm marketings + household consumption + net change in farm inventories) — (farm operating expenses — livestock expenses — expenses for hired labor) — property taxes. Farm operating expenses consist of expenditures for feed, seed, fertilizer and lime, repairs and opera-

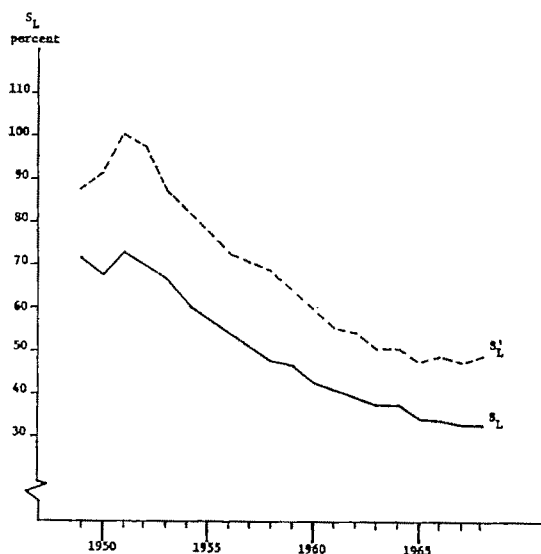


Figure 1. Relative share of labor in U. S. agriculture

tion of capital items, and miscellaneous items. Livestock expenses were subtracted from operating expenses because their effect on output is not exhausted within the year in which the expenditure is made. The difference, however, on the estimate of S_L is negligible. The procedure for estimating value added implies that output is allocated to two factors: (1) capital, which is measured by the sum of depreciation and other consumption of farm capital plus interest on farm mortgage debt plus net rent to nonfarm landlords, and (2) labor, which is measured in man-hours. The data for the estimation of value added are reported in [13]. To obtain an estimate of the relative share of labor in constant prices, wage rate estimates were deflated by the index of prices paid by farmers (1957-59=100) and the output estimates by the index of prices received by farmers (1957-59=100).

The obtained estimate of S_L is presented in column (4), Table 1, and plotted against time in Figure 1. As can be seen, the relative share of labor, with the exception of 1951, is declining throughout the period under examination, and the decline is dramatic. After 1966 S_L has remained relatively constant, but the time period is so short that this constancy cannot be fully examined at present. A possible explanation of this tendency of S_L to remain constant is the imposition of legal minimum wages to be paid to certain categories of hired farm labor by some categories of employers introduced by the 1966 amendment to the Fair Labor Standards

Act. If this explanation is valid, then it is possible that the constancy of S_L is counterbalanced by a reduction in farm employment caused by the minimum wage.

The estimate of labor's relative income presented above is based on the familiar neoclassical framework that recognizes payments to capital for its contribution to production. This estimate was presented because it establishes in familiar terms the fact that the proportion of agricultural output allocated to labor is diminishing. However, since the intention here is to examine the share of labor in a different framework, an estimate is needed of S_L which is based on a definition consistent with the theory to be used as a framework of analysis. As shown later in this paper, the proportional share of labor in Marx's terms is defined as the ratio of the wage bill over the sum of wage bill plus the surplus-value. To be sure, Marx did not recognize the terms "labor share" (and the corresponding "capital share") as correct terminology for expressing the process of labor value alienation proper of the capitalistic mode of production.¹ However, if one keeps Marx's motivation in mind, it will not distort any element of his framework to define the relative "share" of labor in Marxian terms as the ratio of the wage bill over the sum of the wage bill and the surplus-value. The wage bill is estimated as described earlier. The surplus-value was estimated by subtracting from total agricultural output all production expenses except net rent to nonfarm landlords. The difference consists of rent and profits. The result of estimating the relative share of labor by this procedure is reported in column (5) of Table 1 and shown in Figure 1 by the broken line S'_L . Clearly, labor's relative share is declining throughout the period with an average of .684. It will be observed that in 1951 S'_L was greater than unity which indicates that the wage bill was greater than net output (wage bill plus surplus) and therefore implies that the surplus-value was negative. When one considers a whole

¹ "The habit of representing surplus-value and value of labor power as fractions of the value created—a habit that originates in the capitalist mode of production itself, and whose import will hereafter be disclosed—conceals the very transaction that characterizes capital, namely the exchange of variable capital for hiring labor-power, and the consequent exclusion of the laborer from the product.

"Instead of the real fact, we have the false semblance of an association, in which laborer and capitalist divide the product in proportion to the different elements which they respectively contribute toward its formation" [6, p. 584].

economy this result is unreasonable because labor cannot receive more than what is produced. However, since only one sector of the economy is being examined, a negative surplus in the short run is explainable. Further, in the agricultural sector the majority of farm work is performed by farm operators and unpaid family workers, and a negative surplus therefore implies that nonhired farm workers have not received any wages for their work on their own farms.

The Prophecy of Increasing Misery

Marx has been (and is) discussed widely, read rarely, and misunderstood very often. At the risk of being boring to some readers, a few terms are defined.

Gross output

According to Marx, the value of output (gross output) is the sum of three components: constant capital (c), variable capital (v), and surplus-value (s). Constant capital consists of depreciation and raw materials used in the production process and "does not undergo any quantitative alteration of value" [6, p. 232]. Variable capital is the value of labor-power or wage bill and does undergo an alteration of value in the process of production. The surplus-value is the difference between the value of gross product and the value of capital (constant as well as variable) entered in the production of that product: it thus consists of profits, interest, and rent. Hence, net output is defined as the sum of variable capital and surplus value, $(v+s)$.

The ratio of surplus to wage bill, s/v , is the rate of surplus-value or rate of labor exploitation which expresses the extent of exploitation per unit of labor-power.

The ratio of constant capital to wage bill, c/v , is defined as the organic composition of capital. A small definitional problem has arisen with respect to this ratio since the organic composition of capital is connected with the stock of capital and c is defined as a flow of service per period [8, p. 7]. However, it is convenient for purposes of measurement to retain c/v as the ratio of two flows per period. The term organic composition of capital is retained here with the understanding that it refers to flows rather than stocks.

The prognosis of increasing misery

There have been disagreements as to what Marx meant by "increasing misery." Was

Marx speaking in absolute or relative terms? The interpretation that increasing misery means a continuing absolute decline of income has been joyfully accepted by those who were anxious to show how poor a "prophet" Marx was. Such a view cannot be supported unambiguously when Marx states:

It follows, therefore, that in proportion as capital accumulates, the lot of the laborer, be his payment high or low, must grow worse [6, pp. 708-709].

On the other side, it has been shown convincingly [11] that if the meaning of increasing misery is to be interpreted in the spirit of Marxian framework, then the misery of laborers is increasing in a relative sense. In addition to this, the argument is made [11, p. 117] that the claimed inconsistency between increasing misery and a falling rate of profit disappears if increasing misery is interpreted in relative terms. Thus, for the purposes of this study increasing misery is interpreted to mean not a declining wage rate or a declining share of labor, but a declining share of labor as a proportion of total net income, that is, a declining $v/(v+s)$ ratio.

Relative shares and rate of exploitation

In Marxian terms the relative income share of labor is defined as $S_L' = v/(v+s)$, and the relative income share of the capitalists is defined as $S_K = s/(v+s)$. By dividing S_K by S_L' , s/v , the rate of exploitation, is obtained. Since $S_K = 1 - S_L'$, an increase in the income share of the capitalists is equivalent to an increase in the rate of exploitation.

The rate of exploitation may increase as a result of an increase in the productivity of labor when an increasing proportion of the additional product is appropriated by the capitalists. Note that it is not necessary for an increasing rate of exploitation to keep v constant. It is only necessary to assume an increase in s greater than that of v . In other words, the increasing misery of laborers is not a result of a reduction of total wages, but it is due rather to the inability of the working class (because of their weak bargaining position²) to raise their wages in proportion to the rise in productivity. The main source of

² Parenthetically, we note that the agricultural workers' weak bargaining position may be related to their lack of any effective organization in the form of labor unions, to their low opportunity cost for their labor service, and to the ease of capital-labor substitution.

Table 2. Statistical series for the American agricultural sector, 1949-1968

Year	Wage rate (deflated) (\$)	Employment in man-hours (mils.)	Wage bill (mils. \$)	Organic composition of capital	Relative share of labor S_L'	Relative share of capitalists $S_K = 1 - S_L'$	Rate of exploitation $R = (6) \div (5)$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1949	.791	16,202	12,816	.95	.874	.126	.14
1950	.784	15,137	11,867	1.09	.924	.076	.08
1951	.794	15,209	12,076	1.17	1.075	-.075	-.07
1952	.826	14,442	11,929	1.23	.971	.029	.03
1953	.863	13,870	11,970	1.24	.875	.125	.14
1954	.853	13,310	11,353	1.33	.824	.176	.21
1955	.872	12,808	11,169	1.42	.773	.227	.29
1956	.905	12,028	10,885	1.54	.724	.276	.38
1957	.898	11,059	9,931	1.69	.702	.298	.42
1958	.920	10,548	9,704	1.91	.680	.320	.47
1959	.931	10,301	9,590	1.98	.643	.357	.56
1960	.951	9,795	9,315	2.09	.597	.403	.68
1961	.961	9,400	9,033	2.21	.559	.441	.79
1962	.962	8,979	8,638	2.42	.543	.457	.84
1963	.981	8,664	8,499	2.56	.504	.496	.98
1964	1.001	8,194	8,202	2.68	.508	.492	.97
1965	1.036	7,775	8,055	2.90	.473	.527	1.11
1966	1.079	7,381	7,964	3.21	.487	.513	1.05
1967	1.146	7,269	8,330	3.37	.470	.530	1.13
1968	1.190	6,998	8,328	3.48	.481	.519	1.08

Sources:

Column (1) from various issues of [14].

Column (2) from various issues of [13].

Column (3) is the product of columns (1) and (2).

Column (5) is from Table 1.

Column (6) is one minus column (5).

Column (7) is column (6) divided by column (5).

increases in labor productivity is, of course, the progress in the technology of production. Most of the technical change is of the labor-saving type which, under the technological conditions prevailing in agriculture [4, 12], implies an increase in the capital-labor ratio. For the great majority of workers whose agricultural jobs are eliminated by such a technical progress it is extremely difficult, if not impossible, to find alternative jobs in other sectors of the economy due to the sharp asymmetry of the corresponding labor markets; that is, during periods of recession or of substantial structural changes workers from the nonagricultural sectors can easily reflux into the agricultural labor market while the opposite does not occur. The above type of technical progress, taking place amidst such labor market conditions, results in the creation of the "Industrial (agricultural in our case) Reserve Army."

Increasing misery in American agriculture

Information about the behavior of key variables in the American agricultural sector for the period 1949-1968 is presented in Table 2. It appears that the changes which have actually taken place fit the changes predicted by the Marxian framework of analysis.

Column 1 of Table 2 presents the historical trend of wages per hour, measured as deflated composite wage rate. With the exception of 1950 the wage rate has been increasing throughout the entire period. At the same time the level of employment has been decreasing (column 2). In fact, the decline in employment is faster than the increase in wages so that the wage bill declined from \$12.8 billion in 1944 to \$8.3 billion in 1968 (column 3). Column 4 shows the changes over time of the organic composition of capital which reflect the pace of adoption of new technology in the agricultural production process. This ratio has increased about three and a half times in the last 20 years, from .95 in 1949 to 3.48 in 1968. Column 5 presents the relative share of labor defined in the Marxian sense, taken from Table 1. It is repeated here because it is used for the estimation of the relative share of capitalists in column 6. By dividing column 6 by column 5 the rate of exploitation is obtained in column 7. Remembering that the rate of exploitation is defined as the ratio of the surplus over the value of labor-power, the estimates of column 7 are interpreted as measuring the surplus per unit of labor-power. Thus, if a farm laborer worked, say, 8 hours in 1950, he worked approximately .64 hours for his

employer and 7.36 for himself. In 1967 he worked only 3.48 for himself and 4.52 for his employer. Over the period under examination, the rate of exploitation increased approximately 10 times. To summarize, the statistical information presented in Table 2 makes clear that wages, the capital-wage bill ratio, and the rate of exploitation have all increased simultaneously. If "increasing misery" is interpreted as a reduction in the absolute level of wages, no empirical support is given to the increasing misery prediction from the data of Table 2. But if "increasing misery" is interpreted as a reduction in the relative share of labor, the American agricultural sector from 1948 to 1968 provides a realization of the Marxian prediction.

Two interpretative comments

There are two points to be made with respect to the term exploitation. The first is the different meaning of exploitation in the Marxian and neoclassical systems. In the Marxian sense there is exploitation in an economic system when labor does not receive the entire output, that is, when the surplus-value is positive.³ In the neoclassical sense, in fact, the Pigovian sense, "... work-people are exploited, in the sense that they are paid less than the value which their marginal net product has to the firms employing them" [7, p. 551]. It may be mentioned at this point that labor exploitation in the neoclassical sense has been empirically estimated recently, but it has falsely been called Marxian exploitation [12]. The second comment refers to a peculiarity that arises when the term exploitation is applied to agriculture. In agricultural production a substantial amount of labor-power is supplied by farm owners and family workers. In American agriculture in the 1949-1968 period approximately three-fourths of the labor force consisted of farm operators and unpaid family workers. Although this complication does not change the technical aspects of the estimation of the rate of exploitation, it does introduce the question of whether farmers in a capitalistic system can meaningfully exploit their own labor and that of their families. In the Marxist economic analysis the phenomenon of self-exploitation is explained in terms of the small farmer's desire to maintain his position as a capitalist.

³ In Marx the meaning of exploitation is not limited to economic connotations: "Accumulation of wealth at one pole is, therefore, at the same time accumulation of misery, agony of toil, slavery, ignorance, brutality, mental degradation, at the opposite pole, . . ." [6, p. 709].

Basic to this goal is the necessity of capital accumulation in an environment of fierce competition and technical progress. The ever-increasing land values are an indication of this process of accumulation [2, p. 160], and the concomitant increase in ground rent forces the farmer toward more intensive use of the land and additional nonland investment. As indicated by the rapidly decreasing number of small farmers the attempt to accumulate is not always successful, thus leading toward the farmer's indebtedness and the necessity of accepting a remuneration for his labor which may be inferior to that of an agricultural worker.⁴ Often he requires the same sacrifice from family labor whether or not the family shares his goals.

The Marxist literature has recognized the above pattern for a long time. For example, K. Kautsky wrote:

At the same time that, on the one hand, the concentration of separate capitalist undertakings in few hands is progressing rapidly, on the other hand, the interdependence of seemingly independent concerns increases as the inevitable result of the division of labor. This mutual dependence becomes, however, ever more one-sided in that the small capitalists grow ever more dependent upon the big ones. The same as most of those workers who are now engaged in home industries and who seem to be independent are in fact wage-workers under some capitalist, so also is many a small capitalist, who apparently enjoys independence, tributary to other capitalists, and many a seemingly independent capitalist concern is in fact an appendage of some gigantic capitalist establishment. The dependence of the small upon the large capitalist proceeds probably at a much more rapid pace than the actual concentration of several concerns into one. [3, p. 23]

More recently E. Mandel states:

The small farmers, clinging desperately to their little plot of land, pay usurious rent which expresses their super-exploitation, *their income often being less than that of an agricultural worker.* (Our emphasis.) When they have not even the minimum capital and have to exploit the land they have leased in the form of share-cropping, they transform themselves into real proletarians, working for a wretched wage. [5, p. 289]

Another aspect of the identity of part of the labor force with the owners of the factors of pro-

⁴ For a synthesized picture of the hourly returns to operator and family labor which largely substantiate this point, see [2, Table 9.4].

duction is that it reduces the practical implications of the conflict between capitalists and the working class. The interesting question that arises in this connection is the distribution of the surplus among the farm owners. It is well known that the amount of surplus is positively related to the size of farm where size is measured by the volume of sales. In fact, as mentioned earlier, small farms are being eliminated, as indicated by the decreasing number of farms and the increasing size of the remaining ones. The characteristic of large farms relevant to this discussion is that capital and land owners are different individuals from the farm laborers. Thus, it may be argued that the current state of the agricultural industry is perhaps a transitory phenomenon. If the existing trend continues, capital and land owners will be completely separated from farm laborers, economically speaking. Many other important questions are relevant in connection with the present distribution of surplus and the future of the agricultural sector. For example, what predictions can be made about the morphology of the agricultural market? Will the same degree of competitiveness be retained, or will oligopolies dominate the market? These questions are beyond the scope of this paper.

Summary and Concluding Remarks

Labor's relative share declined from 72 percent in 1949 to 33 percent in 1968 when measured in neoclassical terms, or from 87 percent to 48 percent in the same period when measured in Marxian terms. The empirical results show unambiguously that in a relative sense the share of labor is declining and misery of farm laborers is increasing. The rate of exploitation, which is derived from the share of labor estimates, has also increased ten times over the period studied.

If one accepts the absolute level of income as an index of economic well-being, then as column (3) of Table 1 shows, agricultural workers are enjoying an increasing level of economic welfare. An argument can be made in favor of examining absolute levels of income when one's income is below the subsistence

level, in which case it does not really matter what others are receiving. In this case what is important is to raise one's income above subsistence rather than to lower others' incomes below subsistence. However, once income is above the subsistence level an individual's dissatisfaction is determined by the difference between his income and his aspirations as formed by the level of economic well-being of others. One is inclined to accept the relative rather than absolute share of labor as the relevant basis for analysis.

The approach to the problem utilized in this paper serves to investigate the problem of the declining labor's share from a perspective different from that of neoclassical economists. The neoclassical framework is essentially a theory of resource allocation. The behavior of the relative share of labor is explained by the market mechanism, and it is viewed as a result of that mechanism under the assumption of profit maximization which implies tendency for equality between marginal product of labor and wage rate. In this framework labor exploitation arises as a problem of disequilibrium and no ethical judgment is expressed. On the other hand, the Marxian framework explains the behavior of the relative share of labor in terms of economic conflicts between capitalists and laborers and views (and predicts) its decline as a result of increasing exploitation of labor based on the superior bargaining position of capital owners.

In both theories changes in the capital-labor (capital-wage bill) ratio are of key importance in explaining changes in the relative share of labor, and in both theories the capital-labor ratio changes with the adoption of technological change.

The most important difference between the two theories is, of course, the interpretation of the term exploitation and the resulting social philosophies and predictions about economic and social change. The objective of this paper has been much more narrow and modest: to provide a test of the prediction of increasing misery for one sector of the economy.

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255-133

Government Farm Programs and Commodity Interaction: A Simulation Analysis*

DARYLL E. RAY AND EARL O. HEADY

An econometric simulation model is developed which causally relates resource use, production, price, utilization, and income for major agricultural commodities. The recursive model links related commodity subsectors and utilizes time lags and feedback information. The simulation model is used to analyze the effect of selected public policies for agriculture. The first simulation tests the model's ability to predict the historical behavior of the agricultural sector. Subsequent simulations investigate the implications of free markets, increased input prices, higher price support rates for corn, and higher price support rates for wheat on resource use, output, and income for individual commodities and United States agriculture as a whole.

HISTORICALLY, government price and income farm programs have been aimed at specific commodity groups. Each commodity program has its own price supports, acreage allotments, marketing quotas, or other instrumental variables. Within the framework of Congressional legislation, program administrators annually announce the levels of these strategic variables for each commodity. The collection of variable levels for all programs represents one point in a set of possible combinations. The level of each government policy parameter or variable not only affects a commodity but also affects related agricultural commodities, the entire agricultural sector, and the economy as a whole.

Past econometric investigations have attempted to analyze the impact of government policies in the aggregate [4, 7, 17] or on specific commodities [1, 9, 15]. The number of government program variables and allowances for substitution between commodities (in the form of resource use or final demand) are necessarily limited in these studies. Presented here are results of a simulation model which incorporates specific government policy variables for major agricultural commodities and, where feasible, permits interactions among commodities. This research involves two phases. First, sectorial models are developed for livestock, feed grains, wheat, soybeans, cotton, and tobacco. Each sectorial model causally links resource use, production, price, final demand, and gross

receipts for the particular commodity. The policy variables incorporated in equation specifications include price supports, acreage diversions or allotments, and direct government payments. Second, simulation experiments are run with the model to determine the model's validity and to analyze the impacts of alternative levels of government policy, prices, and technology.

Since lagged responses and secondary effects of policy changes can be incorporated readily, econometric simulation models are especially suited for analyzing agricultural programs. Simulation models designed to solve relations sequentially are parallel to the real world where decisions of producers and consumers not only relate to current economic and technological environments but also are conditioned by past decisions and actions. Hence, econometric simulation is a positivistic method of analysis, unencumbered by inherent optimization rules.

Overview of the Model

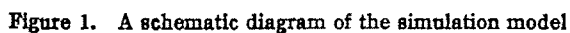
The agricultural economy is disaggregated into commodity groups for which submodels are established. The commodity groups in order of their appearance in the model are livestock, feed grains, wheat, soybeans, cotton, and tobacco. The relations in each submodel sequentially depict the commodity's yearly production cycle from acreage planted (in the crop models) to the level of resource use, to production, to price, to commodity disposition, and finally to gross income. This sequential ordering attempts to capture the recursive nature of agricultural production. The submodels, or blocks of commodity equations, are brought together to form the overall simulation model in a manner which preserves the recursive structure. The submodel organization permits the explicit inclusion of appropriate government policy variables for individual commodities.

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The general structure of each commodity submodel is as follows: (a) acreage and resource demand variables are functions of previous year prices and gross incomes of the commodity under consideration and related commodities, acreage allotments or diversions, previous year resource prices, and resource demand shifters; (b) commodity production is dependent on the quantity and productivity of resources committed to the commodity; (c) commodity supply depends on production, carry-in, and imports;

Figure 1 is a visual presentation of the model's functional relationships. The "pie-shaped" sections represent the six commodity submodels. The variable code names are composed of two parts. The first letter (or letters) identifies the



commodity or aggregate name. The remainder of the code identifies the specific variable being measured. Variable definitions are listed in Table 1. Dependent variables in the figure are enclosed in rectangles, while exogenous variables are surrounded by ovals. Causal ordering is indicated by the direction of the arrow. Lagged values of variables appear outside the perimeter of the circle. The broken circles partition the current dependent variables into three subsets. The area bounded by the circle perimeter and outer dotted circle contains pre-input variables; the area between the broken circles contains input variables; and the output variables appear within the inner broken circle.¹ This categorization of variables into three groups facilitates presentation of the relationships and brings out the recursive aspects of the submodels.

The pre-input sections of the submodels contain equations to estimate acreage (in the crop submodels), ending calendar year stocks of machinery and commodities, the value of land and buildings used in producing the commodity, and total value of physical assets committed to the commodity. Other equations are included to aid in generating the stock estimates; land price equations provide estimates for the value of land relations; estimates of machinery purchases are utilized in the machinery stock equations.

Equations in the input sections of the submodels use information generated in the corresponding commodity's pre-input section along with other data to estimate commodity input demand levels. The input categories included in this section correspond closely to those used by the USDA's Farm Production Economics Division for calculating aggregate input costs [8]. Current or monoproprietor factors of production included in the input sections are fertilizer and lime, seed, labor, and machinery operating expenses. Other equations estimate the flow of services from, or the opportunity costs of, polyperiod or durable resources. Machinery expense (interest and depreciation), real estate expense, interest on commodity stocks, and real estate taxes fall into this latter group of inputs.

The final set of categories, or output sections, contains production functions, supply identities, price equations, commodity utilization

and ending crop year inventory equations, and gross income equations. The livestock output section includes equations to estimate the number of livestock production units fed, livestock marketings, the price of livestock, and gross receipts from the sale of livestock.

In addition, the simulator contains a set of identities which sum variable estimates for the separate commodities into national estimates. Variable levels of commodities not in the model are treated as exogenous, or given data, and are included in the identities.

Some Comments on Equation Specification

Resource use equations

Static firm theory relates the levels of resource use to their prices and productivities and to commodity prices. This theory must be modified to estimate resource use in the real world where farmer capital is limited and response to price and productivity changes is less than instantaneous. Due to the biological lag in agriculture between resource commitment and realized output and price, resource equations are specified as functions of previous year input and commodity prices. Previous year gross incomes, the ratios of assets to liabilities, and measures of asset stocks are included as demand shifters to represent the influence of the availability of capital funds. The income variables indicate changes in the availability of internal funds, while other variables serve as measures of borrowing capacity. The distribution of income, liabilities, and assets among producers has an important influence on aggregate resource demands. However, because of the lack of more precise data, aggregate measures of these financial variables are used. Since time is required to adjust resource use to changing prices, input productivities, and capital constraints, many of the resource use equations are formulated with a geometrically distributed lag structure.

Production functions

Cobb-Douglas production functions are estimated for each crop in the models for each of four time periods. Input variables appearing in the input section of the crop's submodel are the determinants of that crop's production level. The functions are not estimated directly but are constructed after separate estimation of each individual partial production elasticity for

¹ This categorization of variables is similar to variable groupings used by Tyner and Tweeten [17] in their aggregate model of agriculture.

Table 1. Definitions of variable code names used in simulator model.^a

Variable code name	Definition	Variable code name	Definition	Variable code name	Definition
AC	Acreage (million acres)	INT	Interest on farmer hold commodity inventories (million 1947-49 dollars)	SDPI	Index of seed prices deflated by the implicit GNP deflator (1947-49 = 100)
LPUR	Livestock purchased by farmers (million 1947-49 dollars)	RETX	Real estate taxes (million 1947-49 dollars)	FMSZ	Index of acres per farm (1947-49 = 100)
STK	Ending calendar year commodity stock on farms (million 1947-49 dollars)	PROD	Crop production (FC, million tons; W and S, million bushels; C million bales; and T, million pounds)	EQTY	Equity ratio defined as the value of real estate divided by mortgage debt on that real estate
STKAVE	Average of beginning and ending calendar year commodity stock on farms (million 1947-49 dollars)	LPV	Livestock production units (million units)	DIP	Crop year imports (Same units as production)
MPUR	Machinery purchases (million 1947-49 dollars)	MKT	Index of livestock marketings (1947-49 = 100)	MHPI	Index of machinery price deflated by GNP deflator (1947-49 = 100)
MSTK	Ending calendar year stock of machinery on farms (million 1947-49 dollars)	SPY	Beginning crop year supplies defined as the sum of production, carry-in stocks and imports	FPII	Index of fertilizer price deflated by GNP deflator (1947-49 = 100)
MSTKAVE	Average of ending and beginning calendar year machinery stock on farms (million 1947-49 dollars)	PR	Average crop year price received by farmers deflated by the implicit GNP deflator. (L, index 1947-49 = 100; FC, dollars per ton; W and S, dollars per bushel; C and T, dollars per pound)	MSPI	Index of motor supplies price deflated by GNP deflator (1947-49 = 100)
PRLA	Index of price of land and buildings per acre (index 1947-49 = 100)	CD	Total domestic crop year demand for all uses, except wheat in which only nonfood demand is included (Same units as production)	FSPI	Index of farm supplies price deflated by GNP deflator (index 1947-49 = 100)
VALA	Value of farmland and buildings (million 1947-49 dollars)	FD	Crop year demand for wheat as food (million bushels)	PCDI	Per capita disposable income deflated by GNP deflator (1947-49 dollars)
SPA	Stock of physical assets defined as the sum of STKAVE, MSTKAVE and VALA (million 1947-49 dollars)	GINV	Government ending crop year inventory (Same units as production)	BDPI	Index of the price of broad-woven cloth deflated by GNP deflator (index 1947-49 = 100)
FERT	Fertilizer and lime expense (million 1947-49 dollars)	GINV	Commercial ending crop year inventory (Same units as production)	TIME	Trend variable with 1930 = 1.0
SEED	Purchased plus home-grown seed for individual crops (million 1947-49 dollars)	EXP	Crop year exports (Same units as production)	TIME**2	Square of the TIME variable
FEED	Purchased livestock feed (million 1947-49 dollars)	GTMC	Cash receipts and government payments deflated by the implicit GNP deflator (million 1947-49 dollars)	TIME**5	Square root of the TIME variable
LABR	Man-hour requirements (million man-hours)	TXRT	Tax rate per dollar value of land and buildings	WARDUMY	Dummy variable for World War II with 1.0's for the years 1942-47
RACH	Machinery interest and depreciation (million 1947-49 dollars)	SPPR	Average support price levels deflated by the implicit GNP deflator (Same units as price)	POSTWARDUMY	Dummy variable with 1.0's for years 1948-52
RE	Real estate expense including buildings and depreciation, repairs and maintenance on farm buildings (million 1947-49 dollars)	CPYT	Government payments deflated by the implicit GNP deflator (million 1947-49 dollars)	FPPD	Calendar year production of tobacco in all countries excluding the United States (million pounds)
FOR	Machinery fuel, oil and repairs expense (million 1947-49 dollars)	ACATDUMY	Acreage allotment dummy with 1.0's in years allotments were in effect		
NISC	Miscellaneous expenses including pesticides, small hand tools, binding materials, electricity, telephone, etc. (million 1947-49 dollars)	ACDIV	Acreage diverted from production (million acres)		

^aPrescripts on variable code names in Figure 1 refer to commodity categories: livestock (L), feed grains (FC), wheat (W), soybeans (S), cotton (C), tobacco (T), other crops (O) and all commodities (US).

each of the four time periods. Factor share data are used to compute the partial input production elasticities. Factor shares are valid estimates of partial production elasticities only if economic equilibrium prevails. An adjustment model suggested by Tyner and Tweeten [16] is used to correct the factor share estimates for divergence from the equilibrium position. In estimation, dummy variables are used to permit the separately estimated partial production elasticities to change over the observation period. The dummy variable structure used results in crop production functions for 1930-39, 1940-49, 1950-58, and 1959-67.

Price and demand equations

The specification of the commodity demand and price equations are based on a recursive interpretation of market forces. Given the technology level, commodity production (and for the most part commodity supply) is determined by the prices of output and resources of the preceding year. The relative size of the predetermined supply determines the current commodity price, and the quantity demanded is a function of current price. The relative size of current supply can be measured in relation to the quantity demanded for domestic and foreign use the preceding year. Crop price equations were specified as functions of last year's price, the difference between current supply and last year's utilization, and the commodity's average support price.

Separate relations estimate domestic demand, exports, and ending year inventories for each crop as functions of current year price and relevant demand shifter variables such as the number of livestock production units and per capita consumer income.

Econometric Considerations

The recursive structure of the model simplifies the simulation procedure, and under certain conditions, parameter estimates can be obtained with ordinary least squares applied to one equation at a time. However, the conditions that must be satisfied to obtain consistent and efficient parameter estimates with least squares are very stringent. Two of the more important conditions are: (a) the contemporaneous variance-covariance matrix of the model disturbances must be diagonal, and (b) there must be no correlation of successive equation disturbances. That is, the disturbances must be nonautocorrelated. Since these are rather exacting condi-

tions, other estimation procedures were also used. Two-stage least squares are used to estimate equations with more than one dependent variable and, hence, allow for a generalized variance-covariance matrix. The second condition is made less restrictive by allowing the successive error terms to follow a first-order autoregressive scheme. Fuller and Martin's [2, 3] autoregressive least squares procedure is applied to equations with one dependent variable. A method called autoregressive two-stage least squares is used for equations with more than one dependent variable.² Generally, the coefficient estimates of the autoregressive techniques are used in the simulation model if the autocorrelative coefficient estimate is significantly different from zero. All relations are estimated with annual time series data for 1930-1967.

Data

Time series data for many of the commodity resource demand variables are not published. The commodity input series were developed from cost and returns studies, input-output studies, published and unpublished data from the U. S. Department of Agriculture, discussions with officials of the USDA's Farm Production Economics Division, and the national trends of the aggregate input series.³ Published data for the remaining variables are available from USDA.

The Feed Grain Submodel

While space limitations prevent presentation of all six submodels in estimated form, the estimated equations for the feed grain submodel are

² The mechanics of this estimation technique are detailed in Ray [12].

³ For example, the commodity fertilizer data series were developed from survey and census data published by the National Fertilizer Association [13] and the U. S. Department of Agriculture [5, 6] for the years 1927, 1938, 1947, 1954, 1959, and 1964. Estimated tonnages of nitrogen, phosphoric acid, and potash applied to model crops were converted to pounds per acre. Linear interpolations of the per-acre estimates were made for intervening years. The sum over all crops of per-acre application times acreage was compared to published aggregate consumption for each nutrient for the corresponding year. Application rates were uniformly adjusted to reconcile differences. Average 1947-1949 prices for the separate nutrients were used to aggregate nutrient usage by crop. Non-nitrogen fertilizer distribution by crops was used to allocate national lime expense to the individual crops. See Ray [12] for a complete documentation of data sources and derivations and for time series lists of all data.

Table 2. Estimated Equations for the Feed Grain Submodel^a

Pre-input Section	Output Section
$FG-AC_t = 123.44 + .5637 FG-PR_{t-1} - 22.5082 W-PR_{t-1}$ $- 1.0379 FG-ACDIV_t + .1925 FG-AC_{t-1}$ $LS \quad (.2117) \quad (.6271) \quad (.2130) \quad (.1418) \quad R^2 = .797$ $FG-STK_t = -34.22 + 41.7228 FG-PROD_{t-1}$ $ALS \quad (2.9274) \quad (1515) \quad p = -.4845 \quad R^2 = .723$ $FG-STKAVE_t = (FG-STK_{t-1} + FG-STK_t)/2$ $FG-MFUR_t = 88.8782 + 284.1584 POSTWARDUMY + 39.4036 FG-EQTY_{t-1}$ $+ .1025 FG-GINC_{t-1}$ $ALS \quad (.0445) \quad p = .4242 \quad R^2 = .871$ $FG-MSTK_t = -18.351 + .9295 FG-MFUR_t + .7980 FG-MSTK_{t-1}$ $2SLS \quad (.1747) \quad (.0450) \quad R^2 = .963$ $FG-MSTKAVE_t = (FG-MSTK_{t-1} + FG-MSTK_t)/2$ $FG-PRLA_t = -142.33 + 1.8361 FG-PMSZ_{t-1} + .6411 FG-PRLA_{t-1}$ $LS \quad (.4877) \quad (.1237) \quad R^2 = .964$ $FG-VALA_t = -.4778 + .9194 (FG-PRLA_t * FG-AC_t)$ $ATS \quad (.0002) \quad R^2 = .999$ $FG-SPA_t = FG-STKAVE_t + FG-MSTKAVE_t + FG-VALA_t$	$FG-PROD(1932-39) = .0632 FG-FERT_t^{.03243} FG-SEED_t^{.03939} FG-LABR_t^{.28743}$ $FG-MACH_t^{.20900} FG-RE_t^{.24063} FG-FOR_t^{.14243} FG-MISC_t^{.06999}$ $FG-INT_t^{.04776} FG-RETX_t^{.05665}$ $FG-PROD(1940-49) = 1.07778 FG-FERT_t^{.04486} FG-SEED_t^{.03434} FG-LABR_t^{.18963}$ $FG-MACH_t^{.12227} FG-RE_t^{.10796} FG-FOR_t^{.11465} FG-MISC_t^{.03860}$ $FG-INT_t^{.04002} FG-RETX_t^{.01888}$ $FG-PROD(1950-58) = .15513 FG-FERT_t^{.08321} FG-SEED_t^{.03903} FG-LABR_t^{.12936}$ $FG-MACH_t^{.28726} FG-RE_t^{.17451} FG-FOR_t^{.18028} FG-MISC_t^{.06271}$ $FG-INT_t^{.04156} FG-RETX_t^{.03337}$ $FG-PROD(1959-67) = .06593 FG-FERT_t^{.13257} FG-SEED_t^{.03479} FG-LABR_t^{.08478}$ $FG-MACH_t^{.36219} FG-RE_t^{.29539} FG-FOR_t^{.15898} FG-MISC_t^{.1000}$ $FG-INT_t^{.04558} FG-RETX_t^{.05673}$ $FG-SFY_t = FG-PROD_t + FG-CINV_{t-1} + FG-CINV_t + FG-INT_t$ $FG-PR_t = 19.838 + 21.8219 CR-SPPR_t - .2051 (FG-SFY_t - FG-UTIL_{t-1})$ $+ 9.7044 WARDUMY$ $2SLS \quad (2.9788) \quad R^2 = .852$ $FG-CD_t = -10.795 + .7230 L-LPU_t - .2824 FG-PR_t + 6.6410 WARDUMY$ $ATS \quad (.0356) \quad (.1118) \quad p = .1027 \quad R^2 = .959$ $FG-CINV_t = 11.089 + .4859 FG-PROD_t + .9363 (FG-CINV_{t-1} + FG-CINV_t)$ $+ FG-CINV_{t-1} + 6.9024 CR-SPPR_t - .5312 L-LPU_t$ $ATS \quad p = .5264 \quad R^2 = .949$ $FG-CINV_t = 2.0247 - .1533 FG-CINV_t + .1802 FG-PROD_t - .0499 L-LPU_t$ $2SLS \quad (.0187) \quad (.0465) \quad R^2 = .818$ $FG-EXP_t = -.504 + .0464 FG-INV_{t-1} + .9217 FG-EXP_{t-1}$ $ALS \quad (.0174) \quad (.0542) \quad p = -.5074 \quad R^2 = .930$ $FG-GINC_t = 64.607 + .1609 FG-PROD_t + FG-PR_t + .8564 FG-GYPT_t$ $ATS \quad p = .9746 \quad R^2 = .978$
Input Section	
$FG-FERT_t = 114.46 + .0045 FG-SPA_t - 1.3184 US-FITI_{t-1} + 30.6667 TM61$ $+ .8550 FG-FERT_{t-1}$ $2SLS \quad (.0041) \quad (.6957) \quad R^2 = .995$ $FG-SEED_t = -135.311 + .8846 FG-AC_t + 14.8038 TIME^{.5}$ $+ .5799 FG-SEED_{t-1}$ $ALS \quad (.0940) \quad (.1618) \quad p = -.4754 \quad R^2 = .910$ $FG-LABR_t = 1761.9 + 13.1434 FG-AC_t - .2800 FG-MSTKAVE_t - 45.1842 TIME$ $ATS \quad (3.9203) \quad (.0576) \quad R^2 = .970$ $FG-MACH_t = 47.014 + .2635 FG-MSTKAVE_t - 2.5618 TIME$ $2SLS \quad (.0086) \quad (.8233) \quad R^2 = .989$ $FG-RE_t = 2.820 + .0510 FG-VALA_t$ $ALS \quad (.0009) \quad (.0892) \quad p = .8746 \quad R^2 = .997$ $FG-FOR_t = 30.864 + .1043 FG-MSTKAVE_t$ $ALS \quad (.0311) \quad (.2922) \quad p = .9292 \quad R^2 = .977$ $FG-MISC_t = 181.36 + .0099 FG-SPA_t - 2.0179 US-FITI_{t-1}$ $+ 12.0770 TM61 + .3018 FG-MISC_{t-1}$ $ATS \quad (.0017) \quad (.6646) \quad R^2 = .989$ $FG-INT_t = -3.6203 + .0622 FG-STKAVE_t$ $ALS \quad (.0019) \quad (.1442) \quad p = -.5441 \quad R^2 = .936$ $FG-RETX_t = FG-VALA_t * FG-TXKT_t$	

^aCoefficient standard errors are in parentheses. The estimation technique used to estimate parameters are indicated as LS (least squares), ALS (autoregressive least squares), 2SLS (two stage least square) and ATS (autoregressive two stage least squares). The first order autoregressive coefficient is reported as p.

given in Table 2 to indicate the general structure and internal functioning of the submodels.

Pre-input equations

Purpose of the pre-input section (Table 2) is to provide estimates of feed grain acreage, commodity stocks, machinery stocks, and the stock of physical assets needed in the input section to estimate input usage. Previous year simulation estimates of feed grain price, feed grain acreage, and wheat price, along with current year actual data on acreage diversions, are used

to estimate feed grain acreage in the current year. The acreage and price of land estimates determine the value of land used to produce feed grains. The simulated level of feed grain production for the previous year is utilized to estimate the farmer stock of grain. Beginning year machinery stock and current year machinery purchases determine the level of ending year machinery stock. The level of machinery purchases is calculated before the stock estimate and is influenced by gross receipts generated in the last iteration, the equity ratio of the preceding year, and a variable representing

the temporary expansion of machinery purchases following World War II.

Input equations

The input section generates estimates of current year input levels to be fed later into Cobb-Douglas production functions. Determinants of resource use include predetermined variables such as previous year input prices and real estate tax rates and variables that were processed in the pre-input section or were assigned values from the previous year iteration of the simulation model. The feed grain acreage estimate (generated a few equations back in the pre-input section) appears in the seed and labor equations. The average stock of machinery estimate aids in calculating labor usage, machinery interest and depreciation expense, and fuel, oil, and repairs expenses. The value of land estimates appears in the real estate and real estate tax equations, while the stock of physical assets estimate is used in the fertilizer and miscellaneous expense relations.

Output equations

The final submodel section directly or indirectly uses all the information generated in the previous two sections. The input estimates, which are partially dependent on the simulated values for pre-input variables, are funneled into the appropriate feed grain production function. The resulting production estimate, along with carry-in and imports, determines feed grain supply. The level of supply measured against previous year simulated commercial and export demand is used as a determinant of feed grain price. The feed grain price estimate and other variables including the simulated level of livestock production units from the livestock submodel determine the current year disposition of feed grains. The final equation estimates feed grain gross income as a function of current year production, price, and government payments.

A detailed discussion of the specifications and estimated relations for the feed grain and remaining submodels are given in [12].

Model Validation

For use in evaluating policies, predicted equations in a simulation model must be reasonably valid representations of the real system. To be valid, the structural and behavioral relationships in the model should be theoretically acceptable, and the procedures used to estimate

structural coefficients should be consistent with statistical theory. Finally, the model should predict the behavior of the real system with reasonable accuracy [10, 11].

As in all econometric models, many theoretically acceptable specifications are possible for each component relation. Economic theory, *a priori* knowledge of the agricultural sector, and specifications used in related research were used to suggest the set of potential explanatory variables for each dependent variable. Several model formulations were tried before selecting the final model specification.

Procedures used to estimate structural coefficients allow varying degrees of correlation among successive within-equation disturbances and among between-equation disturbances.

Historical verification is used to indicate the model's overall predictive ability. In the validation run (Simulation 1) the estimated model is simulated with no changes in parameter estimates or exogenous data to test the model's ability to predict actual variable levels of the agricultural sector between 1932 and 1967. As a measure of correspondence between simulated and actual values, Theil coefficients [14] are calculated for each of the submodel dependent variables. The Theil coefficient is defined as:

$$u = \frac{\sum (A_t - P_t)^2}{\sum (A_t - A_{t-1})^2}$$

where the actual observation at time t is denoted by A_t and the predicted value at time t is P_t . Table 3 contains the calculated Theil coefficients for selected variables in the commodity submodels. Since estimated variable levels are summed across commodities, scatter diagrams were constructed for the aggregated variables to indicate the overall performance of the model (Fig. 2).⁴ On the basis of the Theil coefficients and the scatter diagrams, it was concluded that the model reproduces historical data with sufficient accuracy to permit using the model to conduct simulation experiments.

Application of the Model

Results of four of the numerous simulation runs are reviewed here. Conditions simulated are: the removal of government price and income support programs, increase in input prices, a 10-percent increase in corn support prices, and a 10-percent increase in wheat sup-

⁴ Actual variable levels are used for non-model commodities.

Table 3. Calculated Theil- u coefficients for selected variables*

Category	Livestock	Feed grains	Wheat	Soybeans	Cotton	Tobacco
Acres	—	.85	.77	1.41	.84	.72
Livestock purchases	1.38	—	—	—	—	—
Ending calendar year commodity stocks	1.25	.81	1.12	.80	.87	.69
Machinery purchases	.83	.74	.84	1.55	.71	.82
Ending calendar year machinery stocks	1.13	.81	1.12	1.19	.81	.96
Price of land	—	.90	.83	.97	1.86	1.02
Value of land	.68	.82	.81	1.23	1.13	1.02
Stocks of physical assets	.75	.88	.86	1.19	1.11	1.03
Livestock feed	1.30	—	—	—	—	—
Fertilizer and lime	—	.47	.80	3.65	1.50	.94
Seed	—	1.38	.76	1.54	.97	—
Labor	1.27	.82	.75	1.83	.73	.73
Machinery	1.14	.87	1.09	1.20	.85	.90
Real estate	.70	.75	.80	1.20	1.07	.94
Fuel, oil, repairs	1.11	1.55	.79	1.02	.78	1.06
Miscellaneous	.70	.78	.80	.69	.98	1.13
Interest on ending calendar year commodity stock	1.41	.78	1.06	.78	.80	.70
Real estate taxes	.55	.82	.96	1.21	.96	.82
Nonlabor expenses	1.08	.72	.80	1.18	.99	.97
Production	—	.68	.76	1.03	.87	.71
Livestock production units	1.41	—	—	—	—	—
Supply	—	1.79	1.29	1.33	2.25	1.42
Livestock marketings	1.28	—	—	—	—	—
Price	1.25	.78	1.17	.75	.85	.86
Commercial demand	—	1.00	.83	1.16	1.54	.80
Government inventory	—	3.41	1.30	—	1.55	—
Commercial inventory	—	.90	1.04	1.04	.89	1.30
Exports	—	2.12	1.31	.70	.79	.90
Gross income	1.19	1.10	.83	1.31	.93	.98

* The Theil- u coefficient is defined as the sum of squared deviations of the actual and simulated values in the current year divided by the sum of squared deviations of current and previous year actual observations.

port prices. The "free market" model (Simulation 2) assumes the absence of government price supports, government diversions, government payments, and acreage allotments and diversions. Input prices are increased by 10 percent in Simulation 3. In Simulation 4 corn price supports are incremented by 10 percent and in Simulation 5 wheat support prices are increased by 10 percent. These "simulation experiments" provide knowledge on the likely effects of different levels of government policy and other variables in resource use, commodity prices, and farm incomes. The results not only indicate what would have occurred had a policy variable been at an alternative level in the past, but also are useful in evaluating the likely consequences of implementing alternative government policies in the future.

Free market model (Simulation 2)

To see how agriculture would have fared under free markets, a simulation model is run with all government policy variables set to zero. The dynamic and distributed lag aspects of the simulation model permit adjustments in resource use and, hence, production in re-

sponse to changes in commodity prices and receipts. Considerable time may elapse before all the primary and secondary effects of the removal of government programs are realized. Accordingly, and to conserve space, average levels of key variables are reported in Table 4 for only the 1959-1967 period. To facilitate comparisons of simulation results with the results of the base or validation simulation (Simulation 1), the average variable levels are converted to index numbers with variable levels in the validation model equal to 100.

Prices and incomes.—In the absence of government price supports and supply control commodity prices and gross incomes are considerably below the estimates of the validation model. For the 1959-1967 period feed grain prices average 52 percent lower, wheat 31 percent lower, soybean prices 22 percent lower, cotton 59 percent lower, and tobacco 38 percent lower. Over the entire 32-year period simulated, crop prices are lower in Simulation 2 than in Simulation 1 by 46 percent for feed grains, 29.8 percent for wheat, and 21.1 percent for soybeans. Lower prices and the absence of government payments depress gross incomes

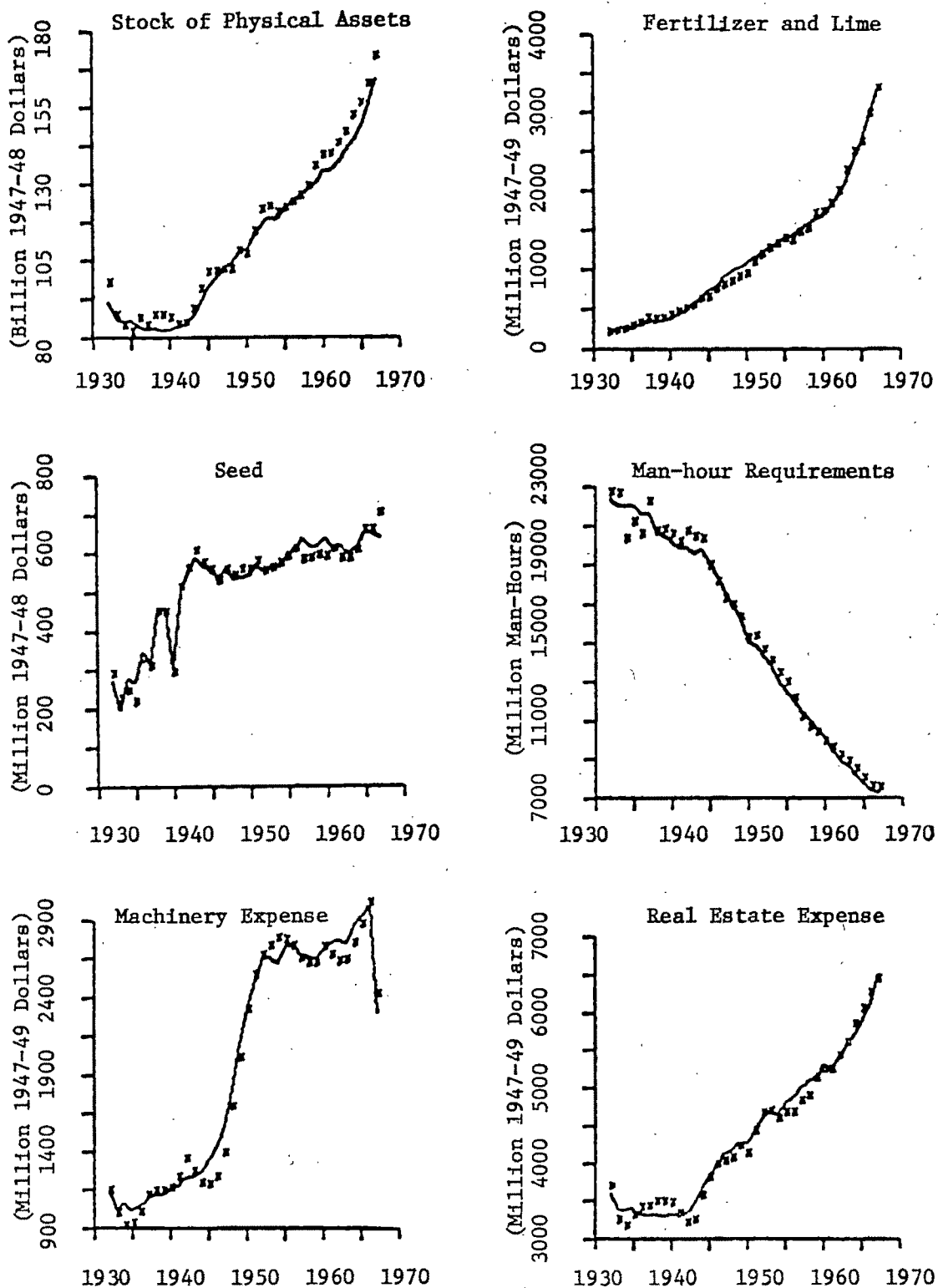


Figure 2. Actual values (x) and simulation estimates (-) of selected United States inputs and incomes, 1932-1967

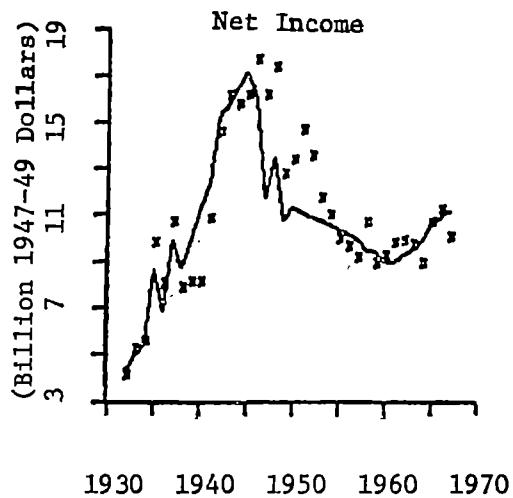
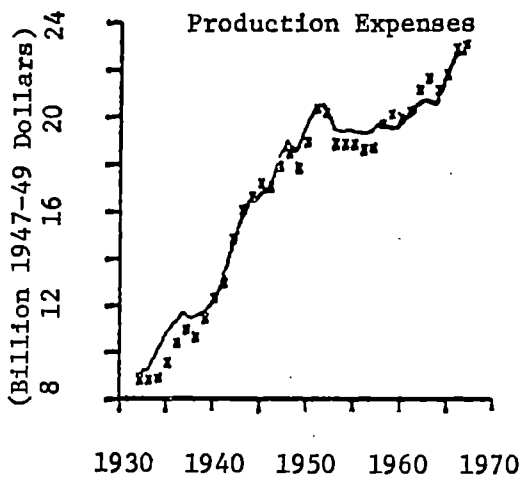
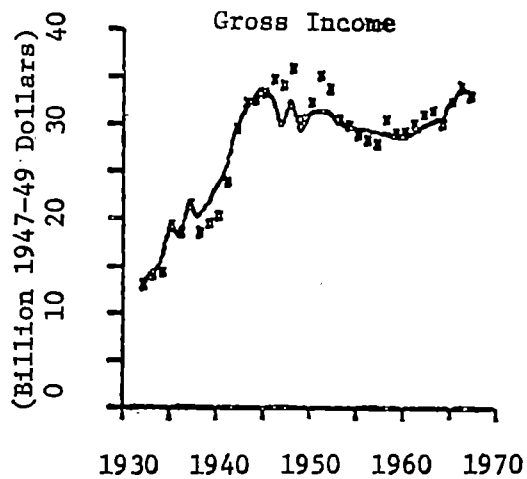
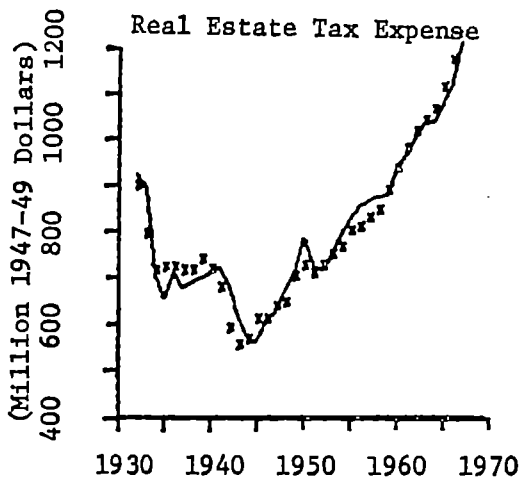
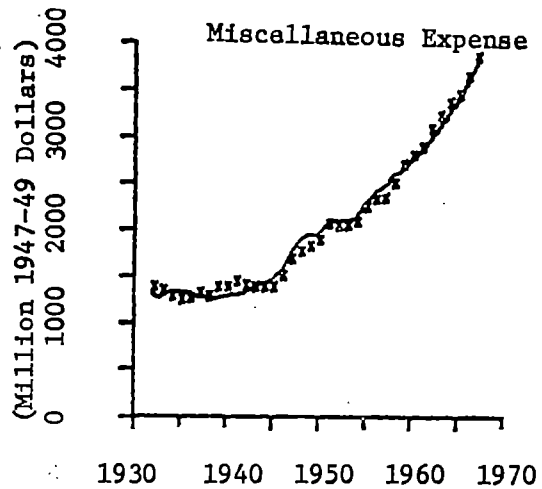
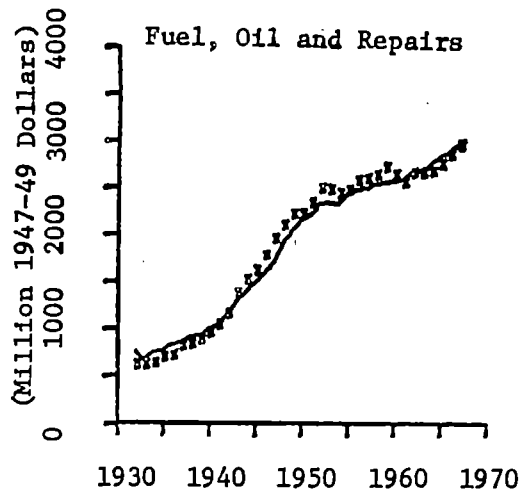


Figure 2, continued

for the individual commodities and for the United States. From Simulation 1 to Simulation 2 feed grain gross income declines 32 percent in the 1959-67 period. Gross incomes for wheat, cotton, soybeans, and tobacco decline by 36, 50, 21, and 50 percent, respectively. Total gross farm income declines by 15 percent and net farm income by 47 percent.

Resource use and production.—Lower prices and incomes without government programs cause a major shift in the resource use structure of agriculture. Fewer highly productive inputs requiring out-of-pocket outlay are used. As estimated by the model, farmers purchase less fertilizer, new machinery, and pesticides under depressed prices of Simulation 2. They rely more on inputs such as land and labor with implicit rather than explicit prices. The depressing effect of lower commodity prices on acreage is more than offset by acreage increases resulting from the absence of acreage allotments and diversions. Feed grain acreage is 25 percent greater in Simulation 2 than in Simulation 1 for 1959-67. The corresponding increases for wheat, soybeans, and cotton are 9, 6, and 5 million acres, respectively. Tighter capital constraints and lower commodity prices reduce machinery purchases and increase labor use in the free market simulation. Demands for fertilizer and miscellaneous inputs are lower for some crops and higher for others, but quantities applied per crop acre of most inputs are lower in Simulation 2 than in Simulation 1. With less machinery, labor requirements are greater under Simulation 2. Nationally, labor usage is 10 percent higher but 74 percent higher for feed grains.

Simulation 2 suggests that farmers would adjust to free markets by altering the mix of inputs and produce nearly the same quantity of output as under historical government programs. Without government price and income support programs, farmers would have had less incentive and financial resources to purchase labor- and land-saving capital inputs. The security and extra capital provided by government programs apparently have enabled efficient farmers to purchase new machinery and other highly productive capital inputs. To realize economies of size associated with larger machinery, many farmers have expanded their operations by securing land from other farmers who retire or transfer to off-farm employment. As a result, agriculture uses less labor on fewer but larger farms than had farm programs been absent. Simulation results sug-

gest that the shift from labor to capital intensive techniques would have occurred without government programs but at a slower pace.

Input prices increased by 10 percent (Simulation 3)

Low incomes and resource returns persist in agriculture because the productivity of resources has increased and the quantity of these resources used is large, relative to the demand for agricultural products. Government programs use acreage allotments and diversions to reduce the land input. However, opportunities to substitute capital and labor for land reduce the effectiveness of acreage control programs. Further, government payments increase farmers' capacity to buy additional capital inputs. Input use controls have centered on land withdrawals since they are relatively easy to police. The simulation model was applied to investigate the effectiveness of higher prices on reducing capital inputs. The government might, for example, levy taxes on the producers of capital inputs to be passed on to farmers as higher prices. Higher input prices should reduce input use and commodity production. Hence, an increase in input price should augment farm revenue due to inelastic output demands. Total input expenditures should decline also if the demand for inputs is price elastic. Extent of the decline in output depends on the partial elasticity of production for the inputs. Net incomes will increase, even though input demands are price inelastic, if the commodity demand is sufficiently price inelastic so that increments to gross revenues are larger than increases in input expenditures.

In Simulation 3 the prices of machinery, fertilizer, farm supplies, and motor supplies were increased 10 percent. Declines in inputs demanded are noted for those input categories directly affected by these price variables: fertilizer and lime; fuel, oil, and repairs; and miscellaneous inputs. For the 1959-1967 period the reduction in input usage (which averages less than 10 percent for most input and crop categories) reduces feed grain and wheat production by 2 percent, cotton production by 4 percent, and soybean and tobacco production by less than one half of 1 percent. Prices increase proportionally more than the reduction in production, and a higher gross income results. Total production expenses, adjusted for the higher input prices, are \$175 million above the comparable Simulation 1 estimate. Net farm income increases by \$91.5 million or about 1

percent. Hence, output reductions resulting from the use of fewer highly productive capital inputs in response to higher input prices boosts output prices and gross incomes more than enough to offset increases in input expenditures. Capital input demands are sufficiently elastic and commodity demands are sufficiently inelastic to cause net farm income to increase with higher input prices.

Support prices increased for corn and wheat (Simulations 4 and 5)

Price supports are an important part of government farm programs. However, few quantitative estimates are available to indicate the impact of a given change in price support levels on farm resource use, production, prices, and incomes. The effects of alternative price support levels were investigated with the simulation model. In Simulation 4 (Table 4) the

corn support price was increased by 10 percent throughout the observation period. Influence of higher support levels on prices received is moderated by attendant output increases which press against an inelastic demand. From the feed grain price relation, the elasticity of feed grain price with respect to the corn support price is estimated to be 0.6. Hence, with all else equal, including program participation rates and acres diverted from production, a 10-percent increase in the corn support rate would raise the price of feed grains 6 percent the first year. But everything is not equal. In the second year farmers increase output in response to the higher price. If farmers increase output by 1 percent and if the price flexibility for feed grain demand is 3, the net increase in feed grain price is 6—(1 × 3) or 3 percent. Estimated feed grain production increases by an average of 0.9 percent for 1959–67 with corn support prices increased

Table 4. Index numbers of changes in selected variables for indicated simulation models by individual commodities and for the United States, 1959–67 (Simulation 1 variable values = 100.0)

Simulation Model and Sector Names	Fertilizer	Labor	Machinery Expense	Fuel Oil and Repairs	Miscellaneous Expense	Production	Price	Gross Income
Free Market								
Livestock	---	102.5	96.7	99.5	97.9	102.5	88.9	92.8
Feed Grains	94.0	174.3	92.8	96.4	97.6	101.8	48.4	67.5
Wheat	100.7	163.7	83.0	97.9	101.9	102.2	68.9	63.3
Soybeans	129.9	135.2	87.3	88.2	102.0	100.4	78.8	78.6
Cotton	114.3	170.7	86.7	89.5	115.5	123.5	41.1	50.2
Tobacco	68.2	66.6	62.8	61.3	66.8	73.7	61.9	50.0
United States	98.6	110.6	93.6	96.4	99.4	---	---	85.2
Increased Input Prices								
Livestock	---	99.8	100.4	86.1	95.5	99.8	101.1	100.7
Feed Grains	91.9	98.3	100.2	100.1	94.5	98.0	104.1	100.6
Wheat	92.1	101.5	101.0	91.9	93.5	98.0	103.7	101.6
Soybeans	97.9	96.9	101.8	99.6	96.1	99.3	101.6	100.7
Cotton	87.9	106.7	89.5	72.8	92.8	95.8	112.9	106.9
Tobacco	95.9	103.4	93.1	80.6	92.8	99.7	101.2	100.8
United States	94.8	100.2	100.0	95.0	96.1	---	---	100.9
Increased Corn Supports								
Livestock	---	99.9	100.2	100.0	100.2	99.9	100.6	100.4
Feed Grains	101.1	100.6	100.4	100.2	100.9	100.9	102.4	101.0
Wheat	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Soybeans	90.3	97.2	98.0	98.1	98.7	98.1	101.1	99.2
United States	100.2	99.9	100.0	99.9	100.2	---	---	100.2
Increased Wheat Supports								
Livestock	---	100.0	100.0	100.0	99.9	100.0	100.2	100.1
Feed Grains	99.6	98.2	100.0	100.0	99.6	99.5	101.1	100.6
Wheat	100.6	99.6	101.8	101.1	101.03	101.2	102.2	103.3
Soybeans	98.3	99.1	99.7	99.7	99.7	99.6	100.5	99.8
United States	99.8	99.8	100.2	100.0	100.0	---	---	100.2

by 10 percent. The average price received increases by 2.4 percent, farm income from feed grains increases by 1.0 percent, and total net farm income remains nearly constant.

The average support price for wheat was increased by 10 percent in Simulation 5. The price of wheat increased by 2.2 percent for 1959-67, wheat production by 1.2 percent, and wheat gross income by 3.3 percent.

Limitations

The simulation model used in this study attempts to integrate econometric representations of individual commodity sectors into a unified model. Selected changes were made in exogenous variables in the deterministic model to evaluate their impact on resource use production, price, and income for individual commodities and agriculture as a whole. Further work on the model will include using stochastic distributions and the experimental generation of the response surface for the endogenous variables. Results from current models should be viewed as preliminary with more definite conclusions awaiting results from the more sophisticated model.

The economic model developed in this study is only one of many model formulations which could be used to portray the resource and output structure of United States agriculture. Other model formulations could improve the

estimates generated. For example, future models will include more linkages between the commodity submodels.

Concluding Remarks

Ideally, a policy simulation model of the agricultural industry should serve as an econometric map of the agricultural economy within the framework of the total national economy. Interactions of the commodity and resource markets within the agricultural sector should be represented as should the lines of influence between the agricultural sector and the national economy. Structural relations should incorporate government policy variables in sufficient detail to simulate a broad range of economic policies. The model should be capable of analyzing the effects of an agricultural policy change not only on the area of its immediate application but also on related agricultural commodities, the entire agricultural sector, and the economy as a whole. Research is needed to develop a definitive model of the agricultural sector that can be tied into existing national forecasting models. Much of the data and all the expertise already exist. Although the model developed in this study is most suited for historical simulations, it is hoped that it might serve as a stepping stone to the construction of a comprehensive forecasting model of the agricultural industry.

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Generalized Constrained Games in Farm Planning*

T. KAWAGUCHI AND Y. MARUYAMA

Constrained games arise when the mixed strategies of a finite rectangular game are subject to further constraints in the form of linear inequalities. Such games permit more realistic and convenient formulation of many decision problems. This paper offers a generalization of the constrained game model which widens the scope of game-theoretic approaches in farm planning. Solution procedures are proposed for Savage's minimax regret, Hurwicz's pessimism-optimism index, and the "Wald-maximax" and "Wald-Savage" criteria. It is shown that the proposed approaches can handle uncertainty in the inequality constraints. An application to a farm planning problem concludes the paper.

CONSTRAINED games arise [18, pp. 254, 277-290] when mixed strategies of a finite rectangular game are subject to further linear inequalities and permit a more realistic and convenient formulation of economic, military, and statistical decision problems [1, 2, vol. II]. In farm planning problems under uncertainty, added constraints (cf., (1.4) below) are convenient in representing resource limitations, technical relations, and other relevant farm constraints. They are also instrumental in incorporating whatever information is available to farmers regarding the relative strategy frequencies of Nature (cf., (1.5) below). Farmers are very seldom in the state of "complete ignorance" that is usually assumed in game-theoretic models, but some information regarding Nature's relative strategy frequencies is almost always available [22]. For instance, it may be known to farmers that the relative frequency associated with a strategy (state) is not smaller than one-third. Or the relative frequency associated with this strategy is not smaller than that associated with another strategy.

For subsequent reference a formal representation of the constrained rectangular game is introduced:

$$(1.1) \quad K(x, y) = \sum_{j=1}^{j=n} \sum_{k=1}^{k=t} x_j c_{jk} y_k$$

$$(1.2) \quad x_1 + \dots + x_n = 1, \quad x_j \geq 0, \quad j = 1, \dots, n$$

$$(1.3) \quad y_1 + \dots + y_t = 1, \quad y_k \geq 0, \quad k = 1, \dots, t$$

$$(1.4) \quad a_{1i}x_1 + \dots + a_{ni}x_n \leq b_i, \quad i = 1, \dots, m$$

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$$(1.5) \quad d_{h1}y_1 + \dots + d_{ht}y_t \geq c_h, \quad h = 1, \dots, s.$$

The c_{jk} 's are the payoff matrix elements; x_j 's and y_k 's are, respectively, the mixed strategy frequencies of the first and second players; $K(x, y)$, where x and y are the vectors of x_j 's and y_k 's, respectively, is the payoff function which specifies the second player's payment to the first, and the fourth and fifth inequalities specify the relevant constraints. Constrained games and the related programming models [12, 14, 16, 17, 22, 24] have recently widened the scope of game-theoretic approaches in farm planning to a considerable extent.

While it is natural to assume, as do most authors, that Nature's mixed strategy frequencies add up to unity (1.3) so that some one of the specified states of nature should surely occur, it may be more convenient and realistic to conceive of a program of activity levels subject to resource constraints (1.4) but not to the probability constraints (1.2). This approach associates variables with the decision maker's alternatives as done in most conventional resource allocation problems using linear programming. Thus, the model¹ being proposed is a generalization of the original constrained game against Nature² and is formally defined as (1.1), (1.3), and (1.4).

¹ Actually, it is possible to generalize the model a little further by discarding both (1.2) and (1.3). In [23] the authors show by means of linear programming the necessary and sufficient condition for the existence of and a computation procedure to obtain the solution to a generalized constrained game that is formally defined as (1.1), (1.4), and (1.5).

² Nature is assumed to be an innocent but haphazard player in this game. She does not necessarily mind revealing her own strategy to the farmer, but the farmer has not been sufficiently observant to obtain information about Nature. Thus, he makes decisions in a state of "complete ignorance." Alternatively, if the farmer takes advantage of Nature's character and collects sufficient information to identify successfully (at least in his own judgment) her relative strategy frequencies, he is facing a decision problem

The specific purpose of this paper is to introduce into this generalized constrained game model the Hurwicz criterion and what may be called "Wald-maximax criterion" and "Wald-Savage criterion," respectively, and propose the solution procedures associated with them. McInerney [17] and Tadros [24] incorporated the Hurwicz criterion into a constrained game, but they did not recognize that the feasible programs, instead of individual activities, more properly constitute a farmer's pure strategies.

There is a well-recognized difficulty with the Hurwicz criterion in specifying an appropriate pessimism-optimism index in advance. This difficulty is sidestepped in this paper by finding the complete set of solutions corresponding to all values of the index. The decision maker himself can then choose the solution from this set. The farmer thereby indirectly chooses the value of the pessimism-optimism index that reflects his preference.

Savage's minimax regret criterion in the context of generalized constrained games due to Hazell [12] will be represented with some modifications in the following section. This representation paves the way for the "Wald-Savage criterion" introduced in the fourth section. The third section introduces the Hurwicz criterion and "Wald-maximax criterion." The fifth section of the paper concerns the problem of uncertainty in the inequality constraints and shows that the procedures developed in other sections remain applicable. An example of farm applications concludes the paper.

Savage's Minimax Regret Criterion

Consider a linear programming problem:

$$(2.1) \quad a_{i1}x_1 + \dots + a_{in}x_n \leq b_i, \quad i=1, \dots, m,$$

$$(2.2) \quad x_1, \dots, x_n \geq 0,$$

$$(2.3) \quad \text{maximize } r_k(x) = c_{1k}x_1 + \dots + c_{nk}x_n.$$

If uncertainty in the gross margin of each activity, say c_j , can be represented by a finite

number of sample values, c_{jk} ($k=1, \dots, t$, corresponding, respectively, to each state of nature), the objective function also takes on a finite number, t , of sample values $r_k(x)$ for any program $x=(x_1, \dots, x_n)$. Here the coefficients of inequality constraints (2.1) are assumed to be constant over k . When uncertainty in these coefficients is introduced in the fifth section, this assumption will be relaxed. Any information with regard to Nature's relative strategy frequencies, y_k 's, is disregarded on the grounds specified in footnote two. Since it is not apparent that $r_k(x)$, $k=1, \dots, t$, is bounded under the constraints (2.1) and (2.2) as is the case with games where only mixed strategies are allowed, it is explicitly assumed that each $r_k(x)$ takes on a finite maximum value r_k under the same constraints.

The regret or risk associated with an arbitrary program x in the k th state of nature is equal to the difference between the maximum attainable value r_k and the realized value $r_k(x)$:

$$r_k - r_k(x) \geq 0, \quad k=1, \dots, t.$$

By definition these differences cannot be negative. The criterion³ due to Savage and Niehans requires one to minimize the maximum value of such regrets. This can be accomplished by solving the following linear programming problem:

$$(3.1) \quad a_{i1}x_1 + \dots + a_{in}x_n \leq b_i, \quad i=1, \dots, m,$$

$$(3.2) \quad c_{1k}x_1 + \dots + c_{nk}x_n + u \geq r_k, \quad k=1, \dots, t,$$

$$(3.3) \quad x_1, \dots, x_n, u \geq 0,$$

$$(3.4) \quad \text{minimize } u.$$

The constraints (3.1) are identical to constraints (2.1) above. It is clear that u cannot be negative, and it can be shown that an optimum feasible solution exists to the problem.⁴ Hazell [12] constructs his regret parametric model on the basis of a formulation similar

³ An alternative criterion is to safeguard against the most unfavorable outcomes and to choose such a program x that will maximize the minimum conceivable gross margin $r_k(x)$ over all states of Nature. This rule corresponds to Wald's maximin criterion and has been introduced into the constrained game model by Imamura [14] and McInerney [16].

⁴ Since it is clear that there exist programs x and u which satisfy the constraints (3.1)–(3.3), and that the objective function u is non-negative, hence, bounded below, the duality theorem of linear programming [4, pp. 128–135, especially p. 134] ensures an optimum feasible solution to this programming problem.

under (subjective) risk instead of under uncertainty. In such a case he can resort to the (probabilistic) decision theory [5, 10] in solving his problem. If the information he has collected proves to be so fragmentary and unreliable that he is unable to identify Nature's relative strategy frequencies confidently, he is in a state of "ambiguity" [6] or "partial ignorance" [15]. In such a case he can either make use of whatever meager information he has and resort to one of the decision rules due to Ellsberg [6], Fellner [8, 9], and others or resort to the solution procedure developed in [23].

to this, although he makes a different assumption in regard to the state of the farmer's knowledge and presumes that Nature's relative strategy frequencies, y_k 's, are known.

The procedure for obtaining optimum programs in terms of the Savage criterion can be summarized as follows: (a) Solve the linear programming problem: Maximize $r_k(x)$ subject to (2.1) and (2.2) for all k 's and obtain the value of r_k for all k 's. (b) Solve the programming problem: Minimize u subject to (3.1), (3.2), and (3.3). The resulting solution is optimum in terms of the Savage criterion.

Hurwicz and Wald-Maximax Criteria

Retain the assumption that $r_k(x)$ attains a finite maximum value r_k , $k=1, \dots, t$, under the constraints (2.1) and (2.2). The Hurwicz criterion chooses from all programs satisfying (2.1) and (2.2) a program x that maximizes the weighted average $h(x)$ of the anticipated maximum and minimum gross margins:

$$\begin{aligned} h(x) &= p \max_i [r_i(x), i = 1, \dots, t] \\ &\quad + q \min_j [r_j(x), j = 1, \dots, t], \\ p + q &= 1, \quad p, q \geq 0, \end{aligned}$$

where p and q are given weights and ($q=1-p$) is called the pessimism-optimism index. When $q=0$, the Hurwicz criterion coincides with the maximax criterion which advocates the maximization of maximum attainable gross margins over all states of nature—a very optimistic or speculative attitude toward uncertain outcomes. When $q=1$, the criterion coincides with the Wald criterion which advocates the maximization of minimum conceivable gross margins over all states of nature—a pessimistic or conservative attitude [15].

To circumvent the difficulty of specifying q in advance one can determine the programs that maximize $h(x)$ for a given value of q , vary the q value to obtain a set of such optimum programs for values of q over its possible range, arrange the optimum programs in increasing (or decreasing) order with respect to q value, and then let the decision maker choose that program which suits him best. He thereby indirectly determines the value of q that reflects his attitude toward an uncertain gross margin.

Define an auxiliary index $g_k(x)$ for an arbitrary q and an arbitrary program x satisfying (2.1) and (2.2) as a weighted average of the

minimum conceivable gross margins over all states and the realized gross margins in the k th state of Nature. That is,

$$g_k(x) = pr_k(x) + q \min_j (r_j(x), j = 1, \dots, t),$$

$$k = 1, \dots, t.$$

Since the second member on the right-hand side is fixed for a given x ,

$$h(x) = \max_k (g_k(x), k = 1, \dots, t).$$

As will be shown below, $g_k(x)$ attains a maximum value g_k under constraints (2.1) and (2.2). Let the maximum of all g_k 's be equal to g_* , then the maximum value of $h(x)$ under the above constraints is equal to g_* .

$$\begin{aligned} \max_x h(x) &= \max_x (\max_k g_k(x)) \\ &= \max_k (\max_x g_k(x)) \\ &= \max_k g_k \\ &= g_*. \end{aligned}$$

Thus, the program that maximizes $h(x)$ coincides with a program which maximizes $g_*(x)$ under the same constraints. Note that s may not be unique. To summarize: in order to obtain the program which maximizes $h(x)$, it is sufficient to search for a program x which maximizes $g_k(x)=g_k$ and then find the maximum over k of these g_k 's.

The program x 's which maximize $g_k(x)$ for a given k subject to constraints (2.1) and (2.2) can be obtained for all values of q as follows:

Set up a programming problem:

$$(4.1) \quad a_{i1}x_1 + \dots + a_{in}x_n \leq b_i, i = 1, \dots, m$$

$$(4.2) \quad c_{1k}x_1 + \dots + c_{nk}x_n \geq f$$

$$(4.3) \quad -c_{1j}x_1 - \dots - c_{nj}x_n + v_1 - v_2 \leq 0,$$

$$j = 1, \dots, t$$

$$(4.4) \quad x_1, \dots, x_n; v_1, v_2 \geq 0, f \text{ is a parameter}$$

$$(4.5) \quad \text{maximize } (v_1 - v_2).$$

Constraints (4.1) are identical to constraints (2.1) above. The constraint (4.2) requires that the gross margin in the k th state of nature, $r_k(x)$, may not fall short of f , and (4.3) requires that the minimum conceivable gross margin over all states may not fall short of $(v_1 - v_2)$. This problem can be solved for various values of f ranging from a sufficiently small number

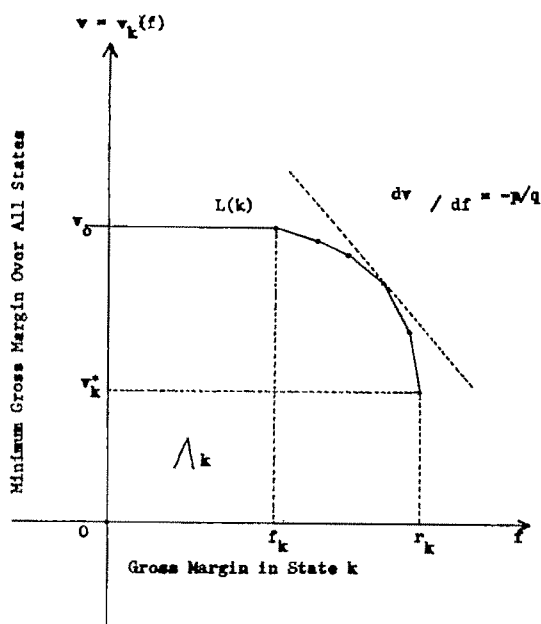


Figure 1

to r_k .⁵ The maximum functional values $v_k(f)$ $= v_1 - v_2$ corresponding to various values of f will be depicted like the curve $L(k)$ in Figure 1. The $v_k(f)$ is defined for all $f \leq r_k$. It attains the maximum value v_0 for all $f \leq f_k$, or alternatively, f_k is the maximum f such that $v_k(f) = v_0$. It is piecewise linear, monotone decreasing, and concave for $f_k \leq f \leq r_k$.⁶ When $f = r_k$, it takes on the value v_k^* . It follows that v_0 is equal to the maximum value of minimum gross margin attainable under the constraints (4.1) and (4.4) and is independent of the suffix k , since the constraint (4.2) is not binding for $f \leq f_k$, and the constraints (4.1), (4.3), and (4.4) are common to all programming problems. For $f_k \leq f \leq r_k$ the curve $L(k)$ represents the maximum value of minimum gross margins attainable under the constraint that $r_k(x) = f$. Alternatively, it represents the maximum value of $r_k(x)$ attainable under the constraint that the minimum conceivable gross margin is equal to $v_k(f)$. Since $r_k(x)$ cannot exceed r_k and $v_k(f)$ cannot exceed v_0 for an arbitrary program x that satisfies (4.1) and (4.4), the point $(f, v) = (r_k(x), \min_j [r_j(x), j = 1, \dots, t])$ is contained in the

⁵ If $f \leq r_k$, there obviously exist programs x , v_1 , and v_2 which satisfy (4.1)–(4.4). Furthermore, (4.3) indicates that $(v_1 - v_2) \leq \min_k (r_k, k = 1, \dots, t)$. Therefore, the duality theorem assures this problem of an optimum feasible solution for $f \leq r_k$.

⁶ For the properties of parametric linear programming, see Madansky [19, especially Lemmas 1 and 2, p. 198].

closed convex set Δ_k that lies on and under the curve $L(k)$. Therefore, the program x which maximizes $g_k(x) = pr_k(x) + q \min_j [r_j(x), j = 1, \dots, t] = pf + qv$ under the constraints (4.1) and (4.4) coincides with the program represented by the point where the curve $L(k)$ is tangent to the straight line with a slope equal to $-p/q = -(1-q)/q$. The maximum value of $g_k(x)$, i.e., g_k , is equal to q times the v intercept of the above tangent line. Since $g_k(x) = r_k(x)$ for $q = 0$, the optimum program x that is associated with $f = r_k$ will maximize $g_k(x)$ for $q = 0$, and the maximum value of $g_k(x)$, i.e., g_k , is equal to r_k . Since $g_k(x) = \min_j [r_j(x), j = 1, \dots, t]$ for $q = 1$, the optimum program x that is associated with $f = f_k$ will maximize $g_k(x)$ for $q = 1$, and the maximum value of $g_k(x)$ is equal to v_0 .

Once the programs x 's which maximize $g_k(x)$ subject to the constraints (4.1) and (4.4) have been obtained for all values of q , the corresponding program x which maximizes $h(x)$ will be easily obtained for all values of q in the following way: (1) Derive the curve $L(k)$ for all k 's. (2) Then superimpose them all, one upon another, on the f, v plane as in Figure 2. In this figure $r^* = \max_k (r_k, k = 1, \dots, t)$ and $f^* = \max_k (f_k, k = 1, \dots, t)$. Suppose that $r_k = r^*$, then v^* is defined to be equal to v_k^* that is associated with the curve $L(s)$ which yields r^* . The shaded area represents the union of the closed convex sets $\Delta_1, \dots, \Delta_t$.

Since $\max_x h(x) = \max_k g_k$ for each value of q , the program x represented by a point of tangency of this set with a straight line (with a slope equal to $-p/q$) will coincide with the program which maximizes $h(x)$ for the corre-

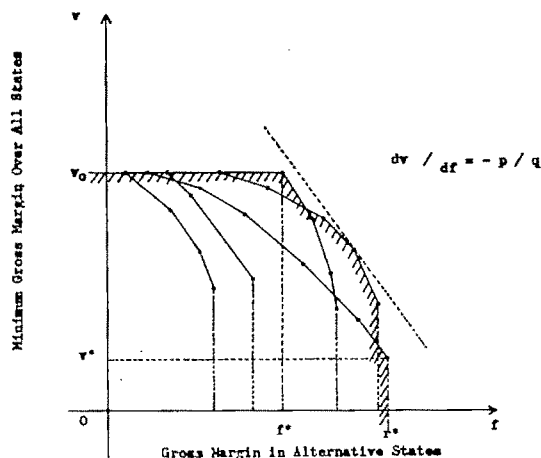


Figure 2

sponding value of q . The maximum value of $h(x)$ is equal to q times the v intercept of the above tangent line. The point of tangency may not be unique.

When $q=0$, the program x represented by the point (r^*, v^*) [more generally, any feasible point (r_k, v_k^*) such that $r_k=r^*, k=1, \dots, i$] will maximize $h(x)$, and the maximum value of $h(x)$ is equal to r^* . This program (more generally, any program corresponding to the above points) coincides with the optimum program in terms of the maximax criterion.

Similarly, when $q=1$, the program x represented by the point (f^*, v_0) [more generally, any point (f_k, v_0) $k=1, \dots, i$] will maximize $h(x)$, and the maximum value of $h(x)$ is equal to v_0 . This program (more generally, any program corresponding to the above points) coincides with the optimum program in terms of Wald's maximin criterion.

Thus, by deriving all the curves $L(k)$, $k=1, \dots, i$, the set of all programs which maximize $h(x)$ for an arbitrarily given value of q can be derived. Finally, it should be noted that the part of $L(k)$ which forms the boundary of shaded area, except for the part where $f < f^*$, represents the locus of the maximum level f of maximum gross margins attainable under the condition that a given level of minimum gross margins is assured. Alternatively, it represents the locus of the maximum level v of minimum gross margins attainable under the condition that a given level of maximum gross margin is assured.

In many practical problems, there is available a short cut which will lead to a considerable reduction in computation. Once r_k has been obtained for all k 's and, at the same time, an optimum program in terms of the Wald criterion is known, it is not usually necessary to derive the curve $L(k)$ for all k 's. Since an optimum program in terms of the Wald criterion is known, its gross margins in all states of nature, hence, the maximum gross margin θ of it is known, and θ is not larger than f^* by the definition of f^* .

Therefore, it is clear from Figure 2 that only those $L(k)$'s whose associated r_k 's are equal to or greater than θ will be required in specifying the set of optimum programs for varying values of q .

Wald-Maximax Criterion

It should be clear from the above development that, except for the special case where the

boundary consists of only one curve $L(k)$, all programs represented by the boundary of the shaded area are not optimum in terms of the Hurwicz criterion for any values of q , since some points on the boundary lie below the tangent line of any slope. However, they also can be regarded as optimum in the sense that they represent such programs that maximize the level of minimum gross margins for some preassigned level of maximum gross margins under the resource constraints (4.1) and (4.4), or alternatively, that maximize the level of maximum gross margins for some preassigned level of minimum gross margins under the same resource constraints. The decision criterion implied here may be called the "Wald-maximax" criterion since it represents a combination of the attitude implied by Wald's maximin criterion and that implied by the maximax criterion. This criterion traces all the maximum levels of minimum (maximum) gross margins for specified levels of maximum (minimum) gross margins, while the Hurwicz criterion is interested only in the rate of trade-off between the two. Thus, all programs that are optimum in terms of the Hurwicz criterion for some value of q are necessarily optimum in terms of the Wald-maximax criterion for some level of minimum (maximum) gross margins, but the reverse is not true. In this sense, the Wald-maximax criterion provides a more general criterion than Hurwicz's.

Wald-Savage Criterion

The Hurwicz criterion or its generalized version, the Wald-Maximax criterion, is a sort of composite criterion, combining Wald's maximin criterion and the maximax criterion, thus representing an effort to remedy some undesirable features of the component criteria. Wald's maximin criterion is considered to be too conservative or pessimistic, while the maximax criterion is obviously too optimistic or speculative. A similar attempt can be made with Savage's minimax regret criterion. When the Savage criterion is applied, it is certain that the conceivable maximum regrets are minimized; however, it is not certain that very low gross margins are prevented from occurring, since this criterion does not pay any attention to the minimum conceivable gross margins [13]. Thus, it may be desirable to combine this criterion with Wald's maximin criterion and to see to it that such very low gross margins are prevented. This new cri-

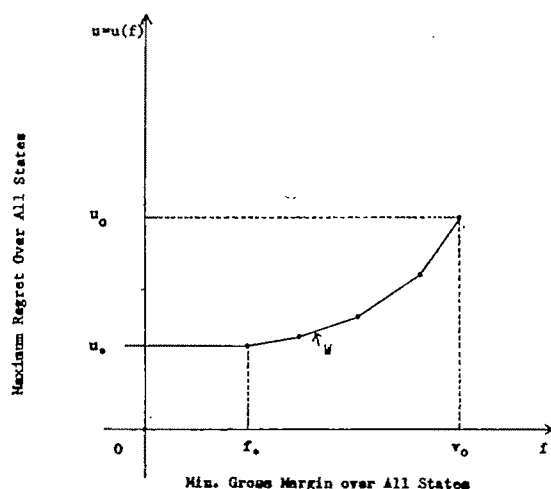


Figure 3

terion may be referred to as the "Wald-Savage" criterion.

The set of optimum programs in terms of the Wald-Savage criterion can be obtained by solving the following parametric linear programming problem.

$$(5.1) \quad a_{i1}x_1 + \dots + a_{in}x_n \leq b_i, \quad i=1, \dots, m$$

$$(5.2) \quad c_{1k}x_1 + \dots + c_{nk}x_n \geq f, \quad k=1, \dots, t$$

$$(5.3) \quad c_{1k}x_1 + \dots + c_{nk}x_n + u \geq r_k, \\ k=1, \dots, t$$

$$(5.4) \quad x_1, \dots, x_n, u \geq 0, \quad f \text{ is a parameter}$$

$$(5.5) \quad \text{minimize } u.$$

The constraints (5.1) and (5.3), respectively, are identical to the constraints (3.1) and (3.2); and the constraints (5.2) are very similar to the constraint (4.2), only the latter applies to a single state while the former apply to all states. Also, (5.2) is identical to (4.3) except that the variables $(v_1 - v_2)$ are replaced by the parameter f . It should be clear that any optimum program minimizes the maximum possible regret subject to the condition that the minimum gross margin does not fall short of f and that the minimum level of maximum possible regret is equal to the minimum functional value of this programming problem. It is supposed that the parameter f does not exceed the maximum level v_0 of the minimum gross margins attainable under the constraints (5.1) and (5.4).⁷ For the values of f ranging from a

sufficiently small number to v_0 , this parametric programming problem generates a series of optimum solutions and associated functional values, $u(f)$. The $u(f)$ values are plotted against various values of f like the curve W in Figure 3.

The curve W is defined for the interval $f \leq v_0$; it is a horizontal straight line $u(f) = u^*$ for $f \leq f^*$, where f^* is the maximum level of f values for which $u(f)$ can stay at its minimum level u^* . It is a monotone increasing convex function consisting of continuous linear segments for $f^* \leq f \leq v_0$. Here u^* represents the minimum value of maximum possible regrets attainable under the constraints (5.1) and (5.4). For $f^* \leq f \leq v_0$, the curve W represents a series of minimum levels of maximum possible regrets attainable under the condition that a given level f of minimum gross margin is assured. Alternatively, it represents a series of maximum levels of minimum possible gross margins attainable under the condition that the maximum regret is equal to $u(f)$. The optimum program corresponding to the point (f^*, u^*) is optimum also in terms of the Savage criterion, while that corresponding to the point (v_0, u_0) is optimum also in terms of the Wald criterion. An average farmer may prefer a greater minimum gross margin to a smaller one, and a smaller maximum regret to a greater one. He can choose the one that suits him best from among the programs represented by the curve W for $f^* \leq f \leq v_0$. Thus, he is able to take into consideration both the minimum gross margins and the maximum regret in making his decision.

Uncertainty in the Coefficients of Inequality Constraints

Heretofore it was assumed that the coefficients of inequality constraints were not subject to uncertainty but were constant over all states of Nature. An attempt is made in this section to relax this assumption.

For simplicity, suppose that the first inequality in constraints (2.1)

$$a_{11}x_1 + \dots + a_{1n}x_n \leq b_1$$

is subject to uncertainty but others are not. Uncertainty in the input-output and restraint coefficients, like that in the functional coef-

atisfying constraints (5.1)–(5.4). Furthermore, (5.3) implies that the functional value u cannot be negative, hence, it is bounded below. Therefore, the duality theorem assures this programming problem of an optimum feasible solution for an arbitrary $f \leq v_0$.

⁷ If $f \leq v_0$, it is clear that there exist programs x and u

ficients, is represented by t states of nature where they take on one of the t sets of sample values, so that the inequality is replaced by the following set of t inequalities:

$$a_{1k}x_1 + \cdots + a_{1nk}x_n \leq b_{1k}, \quad k = 1, \dots, t,$$

where a_{1k} and b_{1k} , respectively, denote the sample value of a_{1j} and b_1 in the k th state of nature. The farmer concerned is supposed to make his choice of a program x without the knowledge of which one of the t states of nature will eventuate. But, he can make up any shortage in the course of executing the program x after some one state of nature has actually eventuated. The assumptions made by Madansky [20] when he introduced his "slack" solution procedure are followed here. Let the amount of shortage to be filled be denoted by $x_{n+k} \geq 0$; then constraints (2.1) are replaced by the following augmented set of inequalities:

$$(6.1) \quad a_{1k}x_1 + \cdots + a_{1nk}x_n - x_{n+k} \leq b_{1k}, \\ k = 1, \dots, t$$

$$(6.2) \quad a_{i1}x_1 + \cdots + a_{in}x_n \leq b_i, \\ i = 2, \dots, m$$

$$(6.3) \quad x_1, \dots, x_n, x_{n+1}, \dots, x_{n+t} \geq 0.$$

The farmer can choose one of the programs $x^* = (x_1, \dots, x_n, x_{n+1}, \dots, x_{n+t})$ satisfying (6.1)–(6.3).

Costs associated with filling the eventuated shortage may be divided into two parts—the costs of procuring additional units (the "cost of shortage" in Evers [7] or the "infeasibility cost" in Hanf [11]) and a kind of fixed cost incurred in filling the shortage (the "set-up cost" in Evers [7]). This latter cost may be negligible in many farm planning problems. Let the cost of filling a unit of shortage in the k th state of nature be denoted by e_k ; then the

gross margin associated with the program x^* in the k th state of nature is equal to

$$(7) \quad r_k(x^*) = c_{1k}x_1 + \cdots + c_{nk}x_n - e_kx_{n+k}, \\ k = 1, \dots, t.$$

In some cases it may be impossible to fill the shortage after some one state of Nature has eventuated. If so, one must either set the relevant x_{n+k} equal to zero or make the relevant e_k prohibitively large. In the case where more than one inequality constraint is subject to uncertainty, exactly the same procedure can be applied. In any regard, uncertainty in the inequality constraints can be made amenable to the approaches developed in the previous sections.⁸

Farm Applications

The four decision criteria developed in the above are applied to a representative upland farm in the northern Hokkaido, Japan. Basic data are adapted from Imamura [14]. Seven activities, i.e., oats, rape seeds, peas, red beans, Irish potatoes, sugar beets, and green manure, are introduced. Nine constraints, i.e., land, labor in seven busy periods, and manure, are considered. Other activities and constraints are omitted for simplicity. Constraints are so specified that sufficient manure is secured for root crops from two sources, green manure and an outside source. The latter represents the manure supplied by workhorses, which are made exogenous to the system under analysis for simplicity since horse time is not considered to become restrictive in usual circumstances. All resources required for workhorses have been subtracted from the restraints under analysis. The associated input-output and restraint coefficients are shown in Table 1. Gross

⁸ For the different approaches to deal with uncertainty in the constraint coefficients see Cocks [3] and Maruyama [21].

Table 1. Input-output and restraint coefficients

Scarce Resources	Oats	Rape Seeds	Red Beans	Peas	Irish Potatoes	Sugar Beets	Green Manure	Restraints
Land (ares)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	698.6
Labor (hours)								
late April-early May	10.00	6.00	.	2.80	8.00	10.80	.30	613.0
mid-late May	.70	.35	13.00	10.00	8.70	.	.	664.0
mid-June	.	.	.	.	.	22.00	.	325.0
late June	.	.	10.00	.	5.70	.	.	298.0
early August	.	16.00	.	.	2.00	.	.	259.0
mid-August	15.00	10.00	.	23.00	.	1.50	.	294.0
late Sept.-early Oct.	.	.	10.00	.	11.20	.	.	580.0
Manure (tons)	.	.	.	.	2.00	1.71	-3.00	11.03

Table 2. Gross margins per unit of activities and maximum attainable gross margins r_k in thousands of yen

States of Nature	Oats	Rape Seeds	Red Beans	Peas	Irish Potatoes	Sugar Beets	Green Manure	r_k
(1) 1951	4.41	6.82	11.84	11.53	6.13	9.61	-.59	656.2
(2) 1952	4.93	5.55	13.56	11.86	12.32	11.51	-.59	745.0
(3) 1953	3.93	4.46	3.04	10.64	4.66	5.40	-.59	313.4
(4) 1954	4.08	6.93	5.07	7.15	6.80	14.83	-.59	511.6
(5) 1955	4.98	7.39	13.71	10.10	2.61	14.36	-.59	783.5
(6) 1956	3.87	5.70	.34	6.07	6.84	12.14	-.59	409.4
(7) 1957	4.92	6.22	14.63	17.75	7.63	15.47	-.59	871.6
(8) 1958	3.22	5.23	11.00	16.90	9.25	14.31	-.59	756.8
(9) 1959	5.67	9.34	15.08	13.96	7.57	14.39	-.59	874.6
(10) 1960	3.55	4.40	8.40	5.93	7.73	14.88	-.59	565.5
Maximum	5.67	9.34	15.08	17.75	12.32	15.47	-.59	—
Minimum	3.22	4.40	.34	5.93	2.61	5.40	-.59	—

margins per unit level of activities in various states of nature are shown in Table 2.

Optimum programs in terms of Savage's minimax regret criterion are obtained in the following way. First, the linear programming problems of maximizing $r_k(x)$ subject to (2.1) and (2.2) are solved to obtain the maximum attainable gross margins r_k for all k 's. The results are summarized in Table 2. Then the linear programming problem of minimizing u subject to (3.1), (3.2), and (3.3) is solved. The minimum functional value, hence, the minimax regret, proves to be equal to 82.7. The associated optimum program in terms of the Savage criterion, its gross margins, and regrets in each state of nature are shown in Table 3. This program appears to be satisfactory in the light of Hildreth's remark [13, pp. 1434-1435] since

Table 3. Optimum program in terms of Savage criterion

Activity Levels (ares)		
Oats		
Rape Seeds		138.5
Red Beans		234.1
Peas		58.0
Irish Potatoes		43.7
Sugar Beets		147.7
Green Manure		76.6
States	Gross Margins (thou. yen)	Regrets (thou. yen)
(1) 1951	602.8	53.4
(2) 1952	682.5	62.5
(3) 1953	290.2	23.2
(4) 1954	500.4	11.2
(5) 1955	700.9	82.7
(6) 1956	326.7	82.7
(7) 1957	788.9	82.7
(8) 1958	675.3	81.5
(9) 1959	804.4	70.2
(10) 1960	541.0	24.5

the associated minimax regret is sufficiently small compared to the maximum attainable gross margins r_k 's.

The $L(k)$'s required for the Hurwicz criterion are derived and superimposed, one upon another, on a single coordinate plane in Figure 4. Some of the curves not used in specifying the set of optimum programs in terms of the Hurwicz criterion were omitted for simplicity. The set of optimum programs corresponding to the curves $L(7)$ and $L(9)$ are shown in Tables 4 and 5. In Figure 4 the union of the regions

Table 4. Selected optimum programs associated with the curve $L(7)$

Parameter Values (thou. yen)			
Gross Margins in State 7(f)	849.2	862.8	871.6
Minimum Gross Margins ($v_7(f)$)	312.8	308.1	258.4
Activity Levels (ares)			
Oats	.	.	.
Rape Seeds	.	.	.
Red Beans	239.4	252.7	298.0
Peas	118.2	118.2	118.2
Irish Potatoes	87.5	79.6	.
Sugar Beets	147.7	147.7	147.7
Green Manure	105.8	100.5	47.4

Table 5. Selected optimum programs associated with the curve $L(9)$

Parameter Values (thou. yen)			
Gross Margins in State 9(f)	798.6	829.2	874.6
Minimum Gross Margins ($v_9(f)$)	312.8	307.4	290.8
Activity Levels (ares)			
Oats	.	.	.
Rape Seeds	.	40.7	154.4
Red Beans	239.4	264.6	298.0
Peas	118.2	100.5	51.1
Irish Potatoes	87.5	58.6	.
Sugar Beets	147.7	147.7	147.7
Green Manure	105.8	86.5	47.4

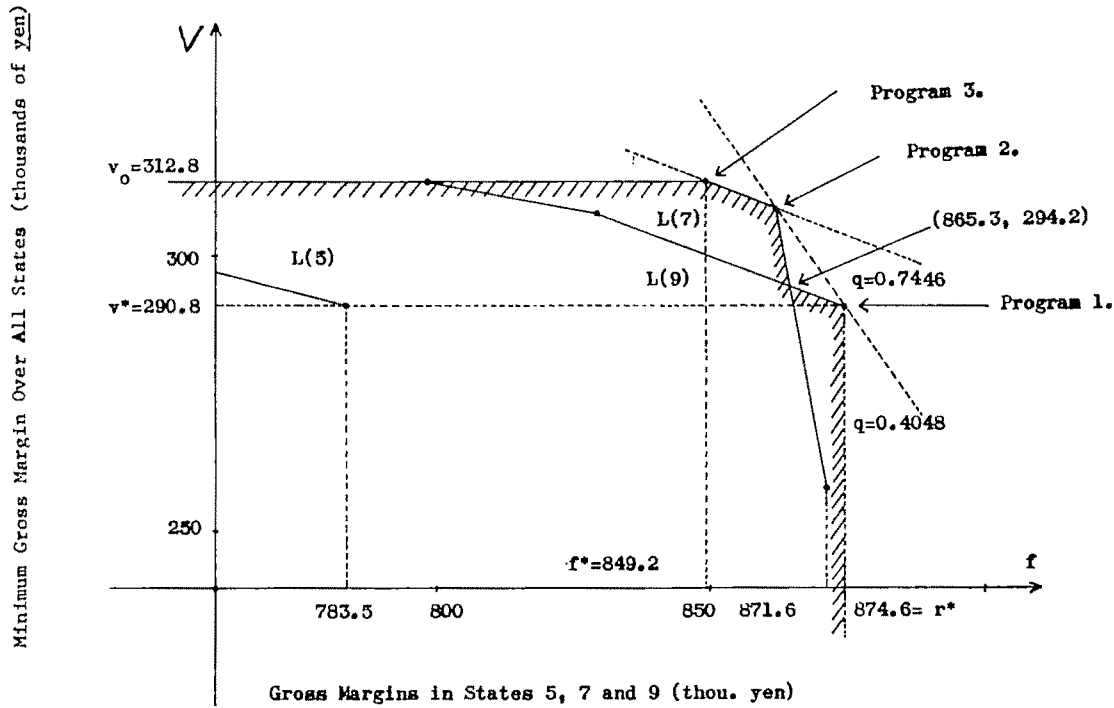


Figure 4

Table 6. Optimum programs in terms of Hurwicz criterion

Parameter Values (thou. yen)	Program 1	Program 2	Program 3
Maximum Gross Margins (f)	874.6	862.8	849.2
Minimum Gross Margins ($v(f)$)	290.8	308.1	312.8
Activity Levels (ares)			
Oats	.	.	.
Rape Seeds	154.4	.	.
Red Beans	298.0	252.7	239.4
Peas	51.1	118.2	118.2
Irish Potatoes	.	79.6	87.5
Sugar Beets	147.7	147.7	147.7
Green Manure	47.4	100.5	105.8
Gross Margins (thou. yen)			
(1) 1951	656.2	620.3	609.2
(2) 1952	717.7	745.0	736.5
(3) 1953	290.8	313.4	312.8
(4) 1954	510.9	479.9	478.3
(5) 1955	783.5	692.7	676.3
(6) 1956	305.6	308.1	312.8
(7) 1957	848.4	862.8	849.2
(8) 1958	703.6	756.8	749.3
(9) 1959	874.6	812.9	798.6
(10) 1960	565.5	557.5	552.2

Program 1 is optimum for $0 \leq q < .4048$

Programs 1 and 2 optimum for $q = .4048$

Program 2 optimum for $.4048 < q < .7446$

Programs 2 and 3, and their convex combinations optimum for $q = .7446$

Program 3 optimum for $.7446 < q \leq 1$

enclosed by these curves are shaded in the same way as in Figure 2. When the value of the pessimism-optimism index q is given, the optimum programs in terms of the Hurwicz criterion are represented by the points of tangency between the shaded area and the straight line with the slope equal to $-p/q$. The set of optimum programs in terms of the Hurwicz criterion corresponding to all values of q and their gross margins in each state of nature are summarized in Table 6. The points of tangency corresponding to programs 1 to 3 in Table 6 are marked with an arrow in Figure 4. Program 3 is optimum in terms of Wald's maximin criterion. As the value of q grows from zero to unity, the corresponding optimum programs show a shift of emphasis from rape seeds and red beans to peas and Irish potatoes. Red beans are a relatively uncertain crop, while rape seeds, peas, and Irish potatoes are relatively safe crops. However, rape seeds cannot compete favorably with peas and Irish potatoes for labor in early to mid-August. The minimum gross margins show a steady rise from $v^* = 290,760$ yen up to $v_0 = 312,788$ yen, while the maximum attainable gross margins show a steady decline from $r^* = 874,615$ yen down to $f^* = 849,200$ yen. The f^* coincides with

Table 7. Optimum programs represented by the intersection of curves $L(7)$ and $L(9)$ ($f=865.3$, $v=294.2$)

Activity Levels (ares)	Associated with $L(7)$	$L(9)$
Oats	.	.
Rape Seeds	.	131.0
Red Beans	265.4	291.1
Peas	118.2	61.2
Irish Potatoes	57.3	12.1
Sugar Beets	147.7	147.7
Green Manure	85.6	55.5
Gross Margins (thou. yen)		
(1) 1951	622.5	650.8
(2) 1952	735.7	721.9
(3) 1953	307.8	294.2
(4) 1954	472.1	506.2
(5) 1955	705.2	769.8
(6) 1956	294.2	305.9
(7) 1957	865.3	850.6
(8) 1958	751.1	711.7
(9) 1959	816.0	865.3
(10) 1960	551.8	564.3

f_7 (associated with 1957 observations) in this example.

Consider the programs which are represented by the intersection ($f=865.3$, $v=294.2$) between the curves $L(7)$ and $L(9)$ in Figure 4. Since they are represented by a point on the outer boundary of shaded area, they must be optimum in terms of the Wald-maximax criterion for maximum attainable gross margin $f=865.3$ or, alternatively, for some minimum gross margin $v=294.2$. However, they cannot be optimum in terms of the Hurwicz criterion, since the corresponding intersection lies below the straight line tangent both to the points representing Programs 1 and 2, respectively. The same remark applies to all the programs represented by the points on the boundary of the shaded area lying between the points representing Programs 1 and 2, respectively. Thus, the Hurwicz criterion is seen to be a special case of the Wald-maximax criterion. Details of the programs associated with curves $L(7)$ and $L(9)$ at the point of intersection are given in Table 7. These programs of course have an identical pair of maximum and minimum gross margins ($f=865.3$ and $v=294.2$).

To obtain the optimum programs in terms of the Wald-Savage criterion for all possible levels of minimum gross margin, the set of r_k values as given in Table 2 is inserted into constraints (5.3). Then, the parametric linear programming problem (5.1)–(5.5) as specified to represent the example farm is solved for all

possible values of f to obtain curve W . The result is shown in Figure 5. All points on this curve represent the optimum programs in terms of the Wald-Savage criterion. These programs minimize the maximum possible regrets relative to gross margins for some given level of minimum gross margins. A selected group of such programs, together with their regrets and gross margins associated with each state of nature, are shown in Table 8. The program associated with the minimum gross margin $f=f_*=290,236$ yen coincides with the optimum program in terms of Savage's minimax regret criterion, while the one associated with $f=v_*=312,788$ yen coincides with the optimum program in terms of Wald's maximin criterion.

Concluding Remarks

The constrained game model was generalized to represent the reality in farm planning under uncertainty more adequately. The generalization widens the scope of constrained game models. However, it requires more computa-

Table 8. Selected optimum programs in terms of Wald-Savage criterion

Parameter Values (thou. yen)			
Minimum Gross Margins (f)	290.2	311.6	312.8
Maximum Regrets ($u(f)$)	82.7	97.8	107.2
Activity Levels (ares)			
Oats	.	.	.
Rape Seeds	138.5	9.4	.
Red Beans	234.1	245.3	239.4
Peas	58.0	114.1	118.2
Irish Potatoes	43.7	80.8	87.5
Sugar Beets	147.7	147.7	147.7
Green Manure	76.6	101.3	105.8
Gross Margins (thou. yen)			
(1) 1951	602.8	613.9	609.2
(2) 1952	682.5	736.8	736.5
(3) 1953	290.2	311.6	312.8
(4) 1954	500.4	480.5	478.3
(5) 1955	700.9	685.7	676.3
(6) 1956	326.7	311.6	312.8
(7) 1957	788.9	851.5	849.2
(8) 1958	675.3	747.8	749.3
(9) 1959	804.4	805.7	798.6
(10) 1960	541.0	553.9	552.2
Regrets (thou. yen)			
(1) 1951	53.4	42.3	47.1
(2) 1952	62.5	8.2	8.5
(3) 1953	23.2	1.9	.6
(4) 1954	11.2	31.1	33.4
(5) 1955	82.7	97.8	107.2
(6) 1956	82.7	97.8	96.6
(7) 1957	82.7	20.1	22.4
(8) 1958	81.5	9.0	7.5
(9) 1959	70.2	68.9	76.0
(10) 1960	24.5	11.5	13.3

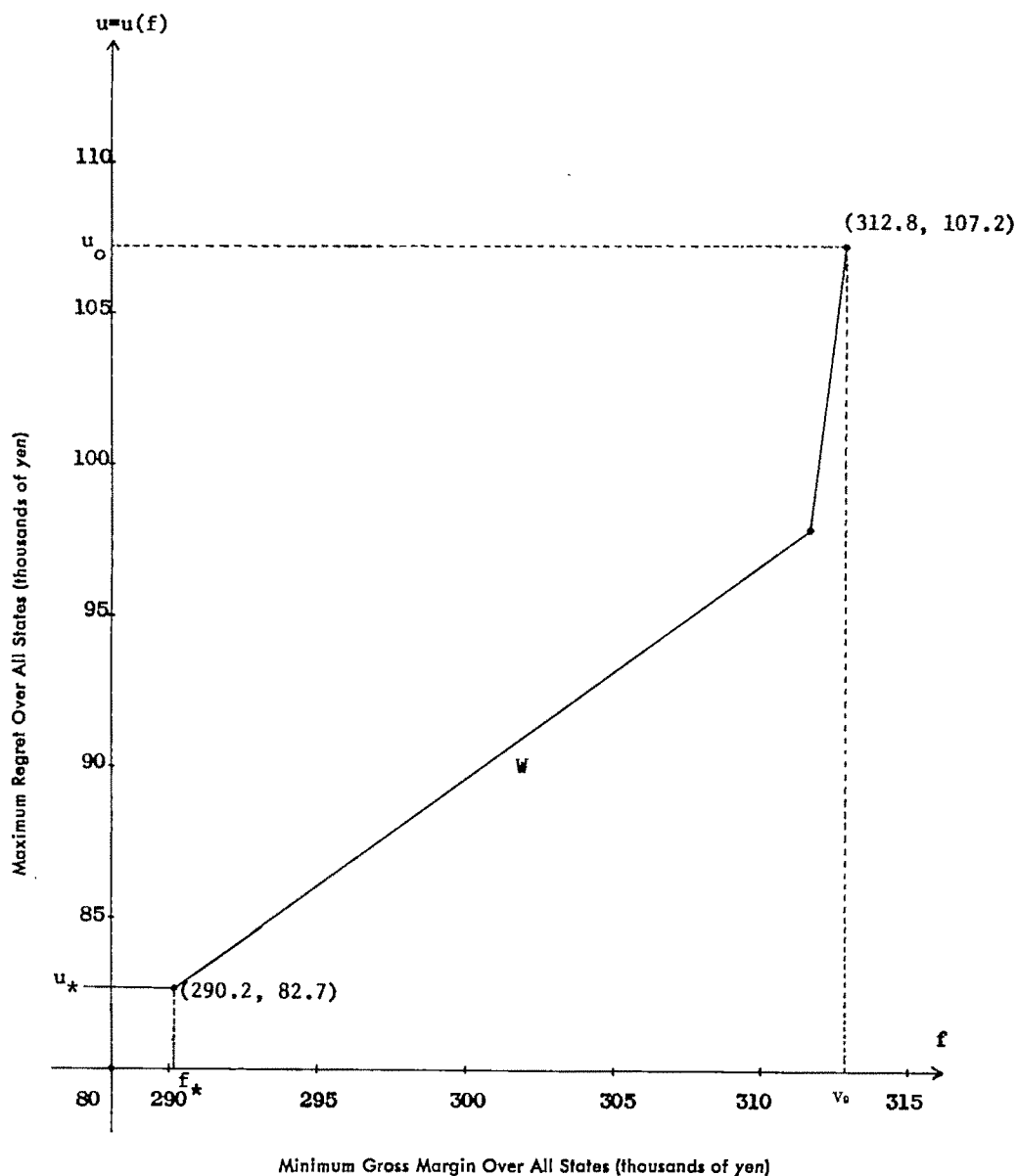


Figure 5

tion than conventional constrained games. This is especially true with the Hurwicz and Wald-maximax criteria. However, if an elec-

tronic computer is available, the computational requirements do not pose a great problem.

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Quarterly Models to Predict Cash Prices of Pork Bellies*

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Quarterly three-equation models designed to predict wholesale cash prices for fresh pork bellies at Chicago, quarterly consumption, and end-of-quarter stocks were developed and fitted by three-stage least squares based on data for 1957-1971. This is the first published econometric study relating to this highly volatile commodity. The major methodological contribution is a demand-for-storage equation that combines a Nerlove-type price expectations adjustment formulation with expectations on the supply side based on data published in the USDA quarterly *Hogs and Pigs*. Useful forecasts of both cash prices and futures quotations were given through the first half of 1972.

A Brief Sketch of Pork Bellies

TRADING in pork belly futures on the Chicago Mercantile Exchange began in September 1961 but the initial volume was small. Major changes in contract provisions were made by 1963 [13]. Volume picked up sharply beginning with the July 1964 contract and has remained relatively large ever since. In 1969, 2,175,775 contracts were traded, the largest for any commodity traded in that year. In its first 10 years, the contract accounted for 9,300,000 transactions—a record for the first decade of any commodity futures contract. Interest in pork bellies as a cash commodity exists chiefly because of the large volume of trading that takes place in futures contracts.

Contracts call for the delivery of 36,000 pounds of frozen bellies in the 12-14 pound weight range from approved warehouses with allowances for freight to Chicago. Certain weight-class substitutions are permitted at specified discounts. Grade standards are listed in detail in the contract. Futures tend to trade above cash quotations for 12-14 pound fresh bellies for the February, March, and May

contracts, suggesting higher quality standards for bellies that are deliverable on the contract than for those normally sold in cash markets. Futures tend to trade at a discount to the cash market for fresh bellies for the July and August contracts, reflecting the fact that frozen bellies normally are not carried beyond September. Frozen bellies in the cash market normally sell at a discount to fresh bellies from some time in the summer through September. Chicago is the major cash market for both fresh and frozen bellies.

Bellies normally are sliced just prior to the sale of the bacon in retail channels. Slicing may take place in meat-packing plants or in warehouses operated by grocery chains or other stores. Data on weekly slicing in meat-packing plants under federal inspection are published by the U. S. Department of Agriculture. However, research done in this study (discussed in detail in [4]) indicates that this series is not a reliable indicator of actual total movement into consumption or retail sale. Only part of the total slicings is covered, and the proportion that is covered apparently varies considerably from time to time.

No published data are available relating either to the production or total consumption of pork bellies. Alternative ways to estimate these were considered. Based chiefly on trade recommendations and on cut-out percentages for hogs over a wide weight range [18], production of bellies was assumed to equal 11.5 percent of liveweight commercial slaughter of hogs. Consumption was estimated from the production series adjusted for changes in stocks. Total stocks in cold storage are published monthly by the USDA [16]. The series on stocks begins with January 31, 1957. The models were fitted to quarterly data for April-June 1957 through January-March 1971.

Storage stocks of bellies normally increase from the seasonal low on September 30 to a

* Texas Tech University, College of Agricultural Sciences Publication No. T-1-104. Research discussed here represents one phase of a study of economic factors that affect futures quotations for pork bellies being done under contract by Texas Tech University for the Commodity Exchange Authority, United States Department of Agriculture. Material given here is condensed from a manuscript for a proposed USDA Technical Bulletin [4] dealing with the overall project. Helpful comments were received from reviewers of an earlier version of the paper.

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seasonal peak around the end of May. During periods in which stocks are being reduced, movement out of storage represents about 10 to 15 percent of total consumption. At no time was the storage movement large relative to estimated production or consumption, but the demand for storage does play a significant role in determining price in both cash and futures markets. Limit up or down moves for futures are a frequent occurrence on the day after release of the U. S. *Cold Storage* report and, at times, limit moves continue for several successive days.

Formulation of the Quarterly Models

Models discussed here were designed to predict wholesale prices for fresh pork bellies at Chicago, U. S. consumption, and end-of-quarter U. S. stocks. In [4] methods to permit forecasts for two quarters ahead after the release of each quarterly *Hogs and Pigs* report are discussed. Due to space limitations, discussion in this paper is confined to the models per se based on known values of the predetermined variables. A major purpose of the models is to determine where prices should have been, based on economic forces in existence at any given time, as one means of determining whether manipulation of cash or futures quotations has taken place. For such use, final data relating to the predetermined variables in the models would be available.

Stoken's [14] general discussion of factors affecting pork belly prices is the only published study in this area, except for short-term reviews by various commodity brokerage houses, and no statistical analyses were used or cited. Many statistical analyses have been published that consider relations between price and consumption of pork. Since the demand function for bacon likely differs materially from that for all pork, no reference is made in this study to these price-consumption relations. Some of these models also considered factors that affect the demand for storage for all pork. These included analyses by Harlow [7], Fuller and Ladd [6], Maki [10], Crom [1], Hayenga and Hacklander [8], and Myers, Havlicek, and Henderson [11].

Many of the models cited were designed for prediction by quarter-years or by months. Most made use of dummy (or 0-1) variables to distinguish between the time periods within each year. When storage is an integral part of the

model, this procedure may be questioned because certain factors may affect storage in a different way when stocks are increasing than when they are decreasing. For this reason, separate sets of equations were used in this study for each quarter.

The price-consumption relation

Interviews with consumers would be needed to determine how and why they decide to consume or not to consume bacon for breakfast. Decisions when cost is a consideration are believed to be made as follows: A decision is made first as to whether to have (a) eggs, waffles, or pancakes or (b) something else. If (b) is chosen, bacon likely will not be eaten. If (a) is chosen, a second decision relates to whether to add some form of meat—normally, bacon, sausage, or ham. All meats add a sizable amount to the total cost. The decision as to which meat, if any, is used may depend chiefly on availability or on taste preferences. If eggs are high priced, decision (b) may be made and, if so, no decision with respect to meat is involved. If eggs are low priced, (a) may be a more likely choice and the consumer may be more willing to add a relatively expensive meat.

Based on the line of reasoning developed by Fox [5], consumption of shell eggs for any given quarter was assumed to be essentially predetermined. Egg prices, on the other hand, may be at least partially endogenous. Thus, the price-consumption relation for pork bellies expressed wholesale prices for fresh at Chicago and derived consumption as dependent on the assumed exogenous or predetermined variables—disposable personal income and consumption of shell eggs. The equations were fitted initially by three-stage least squares in total terms. High correlation between egg consumption and income permitted only one of these variables to come into the equations with the expected positive signs. Hence, the models were refitted with all quantitative variables in this equation in per capita terms. Both egg consumption and income entered in all quarters with the expected positive signs, and price of bellies as a factor affecting consumption entered with a negative sign. Per capita consumption of pork bellies was linearized based on the equations suggested by Klein [9, pp. 120-121] to facilitate derivation of reduced form equations from the models.

The demand-for-storage relation

The method used to estimate storage demand is the major contribution of the models in terms of methodology and likely is a major factor in the success of the equations in predicting prices in and outside the period of fit. End-of-quarter stocks are assumed to depend chiefly on the difference between expected production and expected consumption of bellies for up to two quarters ahead. This presumes that stocks are held chiefly because of an expectation of storage profits. Results from the statistical fit were used to ascertain the extent to which those who determine storage policy make use of advance information in each quarter. Expectations with respect to production were assumed to depend on information in the quarterly USDA report *Hogs and Pigs* [17]. Expectations with respect to consumer income were assumed to depend on projections of recent trends. Expectations for prices on the demand side were assumed to be *adjusted* based on a Nerlove-type adjustment equation [12, p. 25]. An assumption was made that those who determine storage policy for pork bellies ignore the egg economy in deciding how much to store.

Derivation of data from the *Hogs and Pigs* reports was complicated by the fact that those in the December and June reports relate to all states, while those in the March and September reports apply only to 10 major Corn Belt states. Full computational details and methods of handling this problem are given in [4].

For the model based on per capita data for April-June, a number of less important variables entered the storage relation with signs that were contrary to economic expectations. When these variables were omitted, calculated prices from the model deviated more from actual prices than did those computed from a comparable model based on total data both in and outside the period of fit. The occurrence of signs contrary to expectations in this quarter was presumed to reflect problems of multicollinearity in the particular sample combined with the few degrees of freedom that existed for the storage relation. Given this result, the set of preferred analyses referred to in the remainder of this paper consists of the one based on total data for the April-June quarter and those based on per capita data for the price-consumption relation for the remaining quarters. These models suggest that end-of-period

storage is affected by pig crops that will be marketed for one quarter ahead for the January-March quarter and for the second quarter ahead but not the nearby for July-September and October-December. The models suggest that during April-June (the last into-storage period) only supplies in the current quarter are considered.

Full details on all models fitted are given in [4]. Tests also are discussed of the relative forecasting merits of the first-round equations for price from the three-stage least squares fit versus reduced-form equations for price derived from the three structural equations of the model. Calculated prices from the latter are the ones discussed in this paper.

The supply-demand identity

The equation required to complete the model is an identity which states that consumption plus end-of-quarter stocks must equal production plus first-of-quarter stocks. Price must be at a level such that this identity holds. After the consumption and storage equations for each quarter were fitted by three-stage least squares, reduced-form equations for price were derived from the resulting estimates. The algebraically derived reduced-form equation should not be confused with the first-round equation used in the three-stage least squares fit.

The Basic Model

The basic equations were as follows, where t related to the current quarter and $t-1$ to the preceding quarter. All were assumed to be linear with respect to the variables shown.

- (1) $C_t + S_{t+1} = Q_t + S_t$
- (2) $C_t/N_t = f(P_t, I_t/N_t, E_t/N_t')$
- (2.1) or $C_t = f(P_t, I_t)$
- (3) $S_{t+1} = f(\bar{C}_{t+1}^* - \bar{Q}_{t+1}^*, \bar{C}_{t+2}^* - \bar{Q}_{t+2}^*)$
- (3.4) $= f(P_t, S_t, \bar{I}_{t+1}, \Delta I_t, PIGS_{t-2}, PIGS_{t-1}, PIGS_t^*)$

Variables with an asterisk represent expectations on the part of those in the trade who determine policy with respect to storage.

The following variables are involved:

- Q_t = Estimated production of pork bellies during the quarter in million pounds.
- S_t = Cold storage stocks of bellies, first of quarter in million pounds.
- C_t = Derived consumption of bellies during the quarter in million pounds.

P_t = Average wholesale price at Chicago for 12-14 pound FFA or fresh bellies for the quarter in cents per pound.

I_t = Disposable personal income for the quarter at seasonally-adjusted annual rates in billion dollars.

E_t = Civilian consumption of shell eggs for the quarter in billion eggs.

N_t = Total population in 48 states, mid-quarter estimate in millions.

N'_t = Population eating from civilian food supplies in the 48 states, mid-quarter estimate in millions.

ΔI_t = Change in income from the preceding quarter in billion dollars.

$PIGS_t$ = Estimated barrows and gilts farrowed (i.e., born) in specified quarters in millions.

E_t was omitted from (2.1) because if E_t came in with a positive sign, variables relating to income came in with a negative sign. The income variables were assumed to be more important.

In each issue of *Hogs and Pigs*, information is given on the pig crops for $PIGS_{t-2}$ and $PIGS_{t-1}$. Data on number of sows farrowing in relation to $PIGS_t$ also are published, but the number of pigs saved per litter in relation to $PIGS_t$ is based on a trend projection by states weighted by number of sows farrowing, whereas the actual litter size is affected to some extent by weather and other current influences. To indicate an estimate of $PIGS_t$ based on projected litter size for the quarter involved, the symbol $PIGS_t^*$ is used. The following relation is assumed to hold:

$$(4) \quad \bar{Q}_t = f(PIGS_{t-2})$$

This reflects the normal six months required for barrows and gilts from time of birth to time of marketing. Other major factors that affect \bar{Q}_t are average weights at time of slaughter and variations in numbers of gilts held back for breeding or in slaughter of sows. The effect of current price on total slaughter for any given quarter is believed to be minor.

With respect to \bar{C}_{t+1} and \bar{C}_{t+2} , allowance likely would be made by makers of storage policy for expected consumer incomes and expected prices of bacon or pork bellies in these future periods. The relation with respect to expected consumption can be expressed as follows:

$$(5) \quad \bar{C}_{t+1} = f(\bar{P}_{t+1}, \bar{I}_{t+1}).$$

Forecasts of consumer income currently are available from various sources, such as the Wharton School of Finance and Commerce, University of Pennsylvania [2], based on large-scale econometric models of the general economy. However, the Wharton forecasts have been available only since 1963. For purposes of fitting the pork belly model, the assumption was made that those who determine storage policy would have knowledge of the likely level of disposable personal income for the current quarter and would make projections based on the most recent quarter-to-quarter change. This relation can be expressed as:

$$(6) \quad \bar{I}_{t+1} = I_t + \Delta I_t$$

where

$$\Delta I_t = I_t - I_{t-1}.$$

Equation (3.1) allows for the substitutions discussed up to this point in relation to equation (3).

$$(3.1) \quad S_{t+1} = f(\bar{P}_{t+1}^*, \bar{I}_{t+1}^*, PIGS_{t-1}, \bar{P}_{t+2}^*, \bar{I}_{t+2}^*, PIGS_t^*).$$

\bar{I}_{t+1}^* and \bar{I}_{t+2}^* would be highly correlated over the period of fit. For this reason, \bar{I}_{t+1}^* and ΔI_t were used instead. Within the Nerlove framework, \bar{P}_{t+1}^* and \bar{P}_{t+2}^* would be closely related. Hence, \bar{P}_{t+2}^* was dropped. Equation (3.1) thus became:

$$(3.2) \quad S_{t+1} = f(\bar{P}_{t+1}^*, \bar{I}_{t+1}^*, \Delta I_t, PIGS_{t-1}, PIGS_t^*).$$

All variables except \bar{P}_{t+1}^* can be derived from existing data.

The approach used by Nerlove [12] was developed initially to study changes in crop acreage. Producers were assumed to base planting decisions on expectations about what prices would be at time of harvest. Obviously, no data were available with respect to these expectations. However, Nerlove developed a statistical approach by which the nature of these expectations can be derived or estimated from existing data on prices and previous acreage response.

The following equation represents the heart of the Nerlove approach when applied to expectations regarding prices:

$$(7) \quad \bar{P}_t - \bar{P}_{t-1} = \beta(P_{t-1} - \bar{P}_{t-1}).$$

It says that decision makers *adjust* their expectations in proportion to the error that they made in the most recent period. Observations of how farmers react in connection with price-support programs for grains when prices deviate widely from previously prevailing levels for some unforeseen reason, such as the 1970 corn blight, confirm that this equation does provide a representation of behavior on the part of farmers. It seems reasonable to assume that personnel who make decisions about meat storage policy *adjust* their expectations in a similar way.

The required algebraic derivation based on equations (3.2) and (7) is shown in full in [4]. A comparable derivation in a different area is given in Foote [3, pp. 114-116]. The final result is as follows:

$$(3.3) \quad S_{t+1} = f(P_t, S_t, \bar{I}_t, \bar{I}_{t-1}, \Delta I_t, \Delta I_{t-1}, \\ PIGS_{t-2}, PIGS_{t-1}, PIGS_{t-1}^*, PIGS_t^*).$$

Some of the variables on the right were highly correlated. \bar{I}_{t+1} and ΔI_t were chosen to represent the group including these and \bar{I}_t plus ΔI_{t-1} . $PIGS_{t-1}$ was assumed to represent itself and $PIGS_{t-1}^*$ adequately. These modifications result in equation (3.4), which was given as part of the basic model.

Certain theoretical objections can be raised to the use of the Nerlove approach in relation to independently fitted quarterly models since the structural coefficients are assumed to differ from quarter-to-quarter. Nevertheless, the Nerlove approach was used since it gave signs for many of the coefficients (including all for variables known to be important) which were consistent with economic expectations and the models gave good forecasts both in and outside the period of fit.

Fitting Procedures

Price was treated as dependent in the first round of the three-stage least squares fit. A decision was made to drop from the first-round equation predetermined variables in the basic system that might be of minor importance and that came into the equation with signs that were contrary to economic expectations. A similar rule was adopted with respect to equation (3.4). A test of this procedure by

Monte Carlo methods when working with small samples would be desirable. One result was that when all minor variables were retained, the coefficient on current price in equation (3.4) at times was positive, whereas a negative coefficient appears more reasonable. After dropping minor variables with signs that were contrary to expectations, the coefficient on price in all cases became negative.

The models, in effect, were permitted to select among the several variables relating to income. In all cases, at least one came into the first round and each of the two stochastic structural equations with a positive sign. All variables relating to income were highly correlated over the period of fit.

Variables that were expected to be important came into equations (2) or (2.1) and (3.4), the first-round equation for price, and the algebraically-derived reduced-form equation for price for the preferred models in all quarters with signs that were consistent with economic expectations. With minor exceptions, this was true also for all models tested.

Results

The following equations for preferred models were obtained from those fitted by three-stage least squares. The equation for price was derived by algebra from the three equations in the model. Standard errors are shown beneath the coefficients for the two equations fitted directly. Two equations are shown for consumption for all quarters except April-June. The fitted one treated a linearized value of C_t/N_t as dependent. This was transformed into the one relating directly to C_t to facilitate obtaining the reduced-form equations for price.

January-March quarter

$$(8-I) \quad \hat{P}_t = .001409 I_t/N_t + .01141 E_t/N_t' \\ - .1556 S_t - .5850 PIGS_{t-2} \\ - 2.060 PIGS_{t-1} - .05294 Q_t \\ + .1462 N_t - .02617 \bar{I}_{t+1} \\ + .2523 \Delta I_t + 75.86$$

$$(9-I) \quad \hat{C}_t/N_t = .0001399 I_t/N_t \\ (.0000389) \\ + .001133 E_t/N_t' \\ (.005086) \\ - .02349 \hat{P}_t + 3.045 \\ (.00223) \quad (.462)$$

$$(10-I) \quad \hat{C}_t = .02662 I_t/N_t + .2156 E_t/N_t' \\ + 2.761 N_t - 4.770 \hat{P}_t + 54.0$$

$$\begin{aligned}
 (11-I) \quad \hat{S}_{t+1} = & -1.939 S_t - 11.05 PIGS_{t-2} \\
 & (3.557) \quad (27.42) \\
 & -38.91 PIGS_{t-1} + .4943 \hat{I}_{t+1}^* \\
 & (47.39) \quad (.8790) \\
 & + 4.766 \Delta I_t - 14.12 \hat{P}_t \\
 & (3.106) \quad (19.14) \\
 & + 1379 \\
 & (1836)
 \end{aligned}$$

April-June quarter

$$\begin{aligned}
 (8-II) \quad \hat{P}_t = & -.07513 S_t - 3.062 PIGS_{t-2} \\
 & -.02406 Q_t + .005720 I_t \\
 & + .03755 \hat{I}_{t+1}^* + 93.31
 \end{aligned}$$

$$\begin{aligned}
 (10-II) \quad \hat{C}_t = & .2378 I_t - 4.203 \hat{P}_t + 560.9 \\
 & (.0081) \quad (.158) \quad (4.7)
 \end{aligned}$$

$$\begin{aligned}
 (11-II) \quad \hat{S}_{t+1} = & -2.123 S_t - 127.3 PIGS_{t-2} \\
 & (2.377) \quad (114.0) \\
 & + 1.561 \hat{I}_{t+1}^* - 37.37 \hat{P}_t \\
 & (1.329) \quad (31.67) \\
 & + 3318 \\
 & (2912)
 \end{aligned}$$

July-September quarter

$$\begin{aligned}
 (8-III) \quad \hat{P}_t = & .007136 I_t/N_t + .6505 E_t/N_t' \\
 & -.1651 S_t + .1548 PIGS_{t-2} \\
 & -.1056 PIGS_t^* - .1907 Q_t \\
 & + .5732 N_t + .0009121 \hat{I}_{t+1}^* \\
 & - 30.39
 \end{aligned}$$

$$\begin{aligned}
 (9-III) \quad \hat{C}_t/N_t = & .000198 I_t/N_t \\
 & (.000033) \\
 & + .01805 E_t/N_t' \\
 & (.00489) \\
 & -.02605 \hat{P}_t + 2.116 \\
 & (.00176) \quad (.400)
 \end{aligned}$$

$$\begin{aligned}
 (10-III) \quad \hat{C}_t = & .03742 I_t/N_t + 3.411 E_t/N_t' \\
 & + 3.006 N_t - 4.923 \hat{P}_t - 168.3
 \end{aligned}$$

$$\begin{aligned}
 (11-III) \quad \hat{S}_{t+1} = & .1345 S_t + .8155 PIGS_{t-2} \\
 & (.1233) \quad (1.0300) \\
 & -.5537 PIGS_t^* \\
 & (1.2010) \\
 & + .004783 \hat{I}_{t+1}^* - .3200 \hat{P}_t \\
 & (.013760) \quad (.4843) \\
 & + 8.92 \\
 & (44.44)
 \end{aligned}$$

October-December quarter

$$\begin{aligned}
 (8-IV) \quad \hat{P}_t = & .002284 I_t/N_t + .1221 E_t/N_t' \\
 & -.05448 S_t + .4166 PIGS_{t-2} \\
 & -.6460 PIGS_t^* - .1536 Q_t \\
 & + .4554 N_t + .01918 \hat{I}_{t+1}^* \\
 & + 11.26
 \end{aligned}$$

$$\begin{aligned}
 (9-IV) \quad \hat{C}_t/N_t = & .00007841 I_t/N_t \\
 & (.00003560) \\
 & + .004189 E_t/N_t' \\
 & (.004211) \\
 & -.02518 \hat{P}_t + 3.170 \\
 & (.00191) \quad (.393)
 \end{aligned}$$

$$\begin{aligned}
 (10-IV) \quad \hat{C}_t = & .01487 I_t/N_t + .7947 E_t/N_t' \\
 & + 2.965 N_t - 4.777 \hat{P}_t + 38.8
 \end{aligned}$$

$$\begin{aligned}
 (11-IV) \quad \hat{S}_{t+1} = & .6453 S_t + 2.712 PIGS_{t-2} \\
 & (.6093) \quad (2.239) \\
 & - 4.206 PIGS_t^* + .1249 \hat{I}_{t+1}^* \\
 & (3.477) \quad (.0470) \\
 & - 1.733 \hat{P}_t + 34.5 \\
 & (1.312) \quad (152.7)
 \end{aligned}$$

Calculated values from these models over the most recent price cycle are shown in Table 1. In terms of monthly averages, cash prices at Chicago dropped from 45.0 cents per pound in January 1970 to a low of 22.0 cents in January 1971. They remained low through most of 1971 but by January 1972 had reached 35.3 cents. Data used in fitting the equations ran through the first quarter of 1971. Data from published sources issued through May 1972 were used in these calculations. Thus, calculations for April-June 1972 represent at least in part a near-quarter prediction using data relating to the predetermined variables from the March 1972 *Hogs and Pigs* [17].

Calculated prices were substantially above the actual average for the fourth quarter of 1971 and were substantially below the actual average for the first quarter of 1972. In a sense, the models may have been more "right" than the trade. Stocks on September 30, 1971, of 51.5 million pounds were more than double any for that date of record. Many traders expected a sharp drop in cash prices. However, quotations for February and March 1972 futures were such as to encourage large holdings of stocks. In terms of monthly averages, the low point for cash prices in the last half of 1971 was 23.7 cents in September. For December the average was 28.0 cents and for January 1972, 35.3 cents. However, by March, the price averaged 33.4 cents. For the second quarter of 1972 the model predicted a modest price advance from the March level and this occurred.

Inequality coefficients based on Theil's U formula [15, p. 28] for all three endogenous variables over the period of fit and for the most recent price cycle are less than unity, indicating that calculated values from the models are better than a naive no-change forecast. Cal-

Table 1. Pork bellies: calculated and actual values for three endogenous variables from models fitted by quarters by three-stage least squares, 1970-72^a

Year and quarter	Cash price at Chicago		Estimated consumption		End-of-quarter stocks	
	Actual	Calculated	Actual	Calculated	Actual	Calculated
	(Cents per pound)		(Million pounds)			
1970:						
I	43.5	42.4	524	515	61	69
II	41.0	42.9	553	544	67	76
III	37.6	38.9	622	622	10	11
IV	24.0	24.2	633	639	76	70
1971:						
I	23.1	24.3	621	614	114	120
II	23.3	26.7	629	625	139	143
III	24.0	23.1	695	719	52	28
IV	25.7	29.7	638	623	86	101
1972:						
I	34.4	29.4	582	600	108	91
II ^b	35.0	34.9	592	599	106	148

^a From models for which the price-consumption relation was based on total data for April-June and on per capita data for the remaining quarters.

^b Calculated values based on data in the March 1972 *Hogs and Pigs* [17] and the May 1972 *Cold Storage* [16]. Calculated pork belly production, as estimated from equations in [4], was too large. Based on actual production, the model gave the following calculated values: Price—36.1 cents, consumption—594 million pounds, stocks—103 million pounds.

culations over the period of fit were based both on year-to-year and quarter-to-quarter changes. The latter are believed to be more significant, but small coefficients could result from normal seasonal movements rather than from a successfully fitted model. If the coefficients are small on both bases, the models must be reflecting major economic variables that are effective. The largest Theil coefficient on price as computed from the reduced-form equations for the models chosen was 0.178 based on year-to-year changes over the period of fit and 0.362 based on quarter-to-quarter changes. A coefficient of zero indicates perfect forecasts; a coefficient of unity indicates that the forecasts are not better on the average than a naive no-change forecast. Similar coefficients based on the most recent price cycle were less than 0.5. These coefficients are shown in Table 2.

Concluding Remarks

All variables that were expected to be important entered the equations with signs that were consistent with economic expectations. A complementary reaction between consumption of pork bellies and eggs was found for models in which the price-consumption relation was expressed in per capita terms in each quarter. The models gave accurate forecasts of the endogenous variables through the first half of

1972, representing a period about a year beyond the period of fit. They also can be used with certain other equations relating to production (Q_t) to give reliable predictions of likely changes in the level of futures quotations following the release of each issue of *Hogs and Pigs*.

Table 2. Pork bellies: Theil inequality coefficients for specified periods based on preferred three-equation models

Period and quarter	Variable		
	Cash price at Chicago	Estimated consumption	End-of-quarter stocks
<i>Based on year-to-year comparisons</i>			
Over the period of fit:			
I	.095	.224	.338
II	.178	.236	.192
III	.157	.065	.347
IV	.105	.140	.282
<i>Based on quarter-to-quarter comparisons</i>			
Over the period of fit:			
I	.295	.261	.245
II	.362	.252	.399
III	.359	.062	.038
IV	.133	.291	.169
Over the most recent price cycle ^a	.412	.268	.252

^a Based on analyses in all quarters for which the price-consumption relation was in per capita terms.

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Use Rates, Resource Flows, and Efficiency of Public Investment in Range Improvements*

JOE B. STEVENS AND E. BRUCE GODFREY

A theoretical model of interactions between use rates and resource flows over space and time is developed, and a static empirical model is derived for *ex post* analysis of public range investments on the Vale Project (Oregon). Five investment practices varied widely in their marginal productivities. For every Animal Unit Month (AUM) of grazing produced directly by investment, an additional 0.5 AUM was obtained by manipulation of use rates to allow increased natural regeneration. Overall, the Vale Project was inefficient in terms of an implicit redistributive objective as well as the explicit national income objective.

S. V. CIRIACY-WANTRUP's book, *Resource Conservation: Economics and Policies*, has been widely cited in the natural resource literature in several disciplines since its publication in 1952 [7]. Despite an abundance of citations, there is reason to suspect that Ciriacy-Wantrup's rigorous treatment of certain fundamental concepts has been neither fully recognized nor exploited by subsequent researchers. This paper focuses on one such concept, i.e., interactions between use rates and subsequent resource flows. Empirical application is made through *ex post* analysis of a large set of public range investments, the Vale Project (Bureau of Land Management) in eastern Oregon. An argument is developed that the methodology employed here is both necessary in terms of theoretical underpinnings and facilitative in terms of quantitative measurement.¹

Modeling of Interactions: Use Rates, Resource Flows, and Range Investments

According to Ciriacy-Wantrup's classification of resources, different units of flow (re-

newable) resources become available in different time periods; present flows do not diminish future flows [7, p. 37]. For a broad set of flow resources, however, human action in any given time interval may affect future flows. With respect to range resources, human action may take several forms. New seedings, for example, can markedly change species composition, season of use, and forage availability. Other forms of action may have more subtle effects, particularly the rate at which the forage resource is grazed. Excessive use rates can lead to reduced future flows, as evidenced by the history of livestock grazing on much of the public domain [8]. If high use rates erode the capability of basic soil and climatic resources to generate new flows, the forage resource is essentially "mined" as a stock resource.²

Deteriorations in resource flows can also be altered by human action, provided the threshold of irreversibility has not been passed.³ Range forage flows may be restored by investment in seeding and/or brush control. A slower route is through reductions in use rates. The central fact of federal range history is that the latter have been politically unpopular but administratively necessary in that public range investments have only recently become an alternative (or ameliorative strategy) to reduc-

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¹ Subsequent to preparation of the final draft of this paper, two related sets of comments by Bromley [2] and Martin [11] and replies by Burt [4, 5] appeared in the February 1972 issue of the *Journal*. Rather than commenting directly on these communications, let it suffice to say that our confidence in the major arguments set forth in this paper has been bolstered. The last sentence of our opening paragraph provides the principal hypothesis to be tested.

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² Although they are usually managed as flow resources, range forage species have both stock and flow properties. For an example of the use of experimental data to measure effects over time of alternative grazing strategies, see McConnen [12].

³ Ciriacy-Wantrup defines the "critical zone" as a "more or less clearly defined range or rates below which a decrease in flow cannot be reversed economically under present foreseeable conditions" [7, p. 39]. The critical zone can vary with the human action which is contemplated. The practice of spraying for shrub control can result in increased production of native grasses only if the latter exist in some degree of abundance. Plowing and reseedling, on the other hand, may be feasible as long as the more basic soil resources have not been impaired.

tions in use rates.⁴ The relevant technologies have generally been known, but public funds have not been available.

The basic model

The most fundamental manner of modeling the interactions among resource flows, use rates, and range investments (irrespective of resource ownership) involves, as one element, a biological production function for range forage:

$$(1) \quad R_t = R(C_t, C_{t-1}, \dots, C_{t-n}, V_{t-1}, V_{t-2}, \dots, V_{t-n}, U_{t-1}, U_{t-2}, \dots, U_{t-n}),$$

where:

- R_t = production of forage, by species, quality, and/or type,
 C_t = natural and climatic characteristics (soil, rainfall, topography, etc.),
 V = investments designed to increase production,
 U = prior use rates,
 $t, t-1, \dots, t-n$ = time periods.

In correspondence with Ciriacy-Wantrup's terminology [7, p. 31], both resource flows (production of forage) and use rates (utilization or removal) can be conceptualized in terms of physical units (e.g., pounds of forage) per unit of time (e.g., a grazing season). The dependence of resource flow on a prior use rate (e.g., that in the preceding time period) may take one or more of the following forms⁵:

$$(2) \quad \frac{\partial R_t}{\partial U_{t-1}} < 0$$

$$(3) \quad \frac{\partial R_t}{\partial U_{t-1}} = 0$$

⁴ One adjudication (and subsequent grazing reduction) in the Vale District in the late 1950's led to the "Battle of Soldier Creek," which has been well documented by Foss [8] and is nationally known among those familiar with public land management problems.

⁵ The slope of the partial production surface with respect to prior utilization depends in large part upon the specific time of use and the interval length of the time period. Heavy grazing of many species early in the growing season may give rise to equation (2), while the same use rate later in the season may result in equation (3). Crested Wheatgrass, on the other hand, exhibits a grazing-induced tillering of plant growth which results in more high-quality forage when grazed fairly intensively early in the season [equation (4)]. See Sharp [14].

$$(4) \quad \frac{\partial R_t}{\partial U_{t-1}} > 0.$$

Equation (2) symbolizes the early history of grazing on much of the public range and on some private range; "excessive" use rates have caused secular declines in forage production from desired plant species. Equation (3) represents an intertemporal biological equilibrium. Equation (4) represents the possibility for augmenting forage production by means of increased use rates.

The second element of the basic model, determination of use rates, is subject to behavioral incentives and constraints as well as physical relationships:

$$(5) \quad U_t = U(R_t, R_{t-1}, \dots, R_{t-n}, F, V_{t-1}, V_{t-2}, \dots, V_{t-n}),$$

where F represents the institutional framework within which the decision maker operates. Conventional input optimization models would apply to private firms, whereas public resource managers are subject to a broader variety of institutional rules and constraints. Past investments may affect use rates *directly* through water facilities and fencing, as well as *indirectly* through the augmentation of production. The dependence of use rates on both current (R_t) and past production (e.g., R_{t-1}) reflects the fact that for many forage species grazing need not (in a physical sense) be limited to the annual increment of forage.

Expansion to spatial units

The above models can easily be expanded to formalize relationships between spatial units as well as time periods. This is especially useful in that the major types of range investment (seeding and/or brush control) are usually accompanied by protective fencing in order to defer use on these areas. To facilitate expansion of the model, the following definitions and assumptions are made:

- Seeded and/or sprayed areas are defined as Improved areas (*i*), while the remainder of the range unit is defined as the Native area (*n*).
- Investments on Improved areas may influence both production *and* utilization, but investments on Native areas influence *only* the utilization of existing forage. No "new" forage is produced by

Native area investments (fencing and water development).⁶

- (c) The institutional framework allows the decision maker the flexibility to allocate both investment funds and use rates between Improved and Native areas.

A system of first-order difference equations can then be defined to describe production and utilization over successive grazing seasons.⁷ The production of forage on Improved and Native areas might be represented as

$$(6) \quad R_{it} = \alpha_1 C_t + \alpha_2 V_{it-1} - \alpha_3 U_{it-1}$$

and

$$(7) \quad R_{nt} = \beta_1 C_t - \beta_2 U_{nt-1}.$$

Utilization functions for these areas might be defined as

$$(8) \quad U_{it} = \delta_1 R_{it} + \delta_2 V_{it-1} - \delta_3 U_{nt}$$

and

$$(9) \quad U_{nt} = \theta_1 R_{nt} + \theta_2 V_{nt-1} - \theta_3 U_{it}.$$

Figure 1 shows the system in diagrammatic form. Investment variables are shown only in the initial period in order to simplify the presentation.

Impacts of range investments

Given the above definitions and assumptions, the system of first-order difference equations permits one to identify the impact of range investments on forage flows and use rates. If the parameters could be estimated, the marginal productivity of an investment variable could be derived by differentiating the general solution of the system of equations with respect to that variable. Even though highly controlled experimental data would be required to obtain estimates of the parameters, the model is still useful in identifying the paths through which the investments can influence forage flows and use rates and reasons why the realized effects may fall short of physical potential.

⁶ This assumption may not be valid if production on an over-utilized subunit (n_1) of the Native area can be stimulated by transferring grazing pressure to an under-utilized subunit (n_2). This situation can easily be incorporated into the model.

⁷ The choice of variables, expected signs, functional form, and time periods will depend upon research needs, data availability, and agronomic considerations. Resource flows and prior use rates are assumed here to be negatively related, as are use rates on Improved and Native areas.

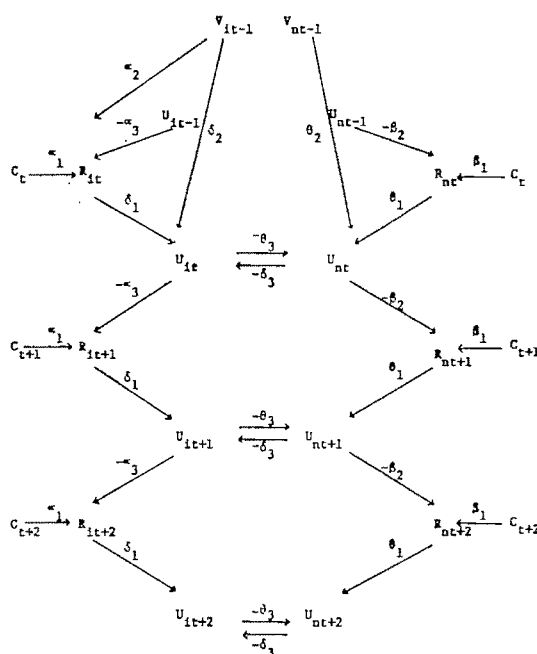


Figure 1. Production and utilization of range forage over time

Improved area investments (V_{it-1}), for example, can give rise to a series of interactions. If increased resource flows (R_{it}) and use rates (U_{it}) on Improved areas can be obtained from these investments (through α_2 , δ_1 , and δ_2), use rates on Native areas (U_{nt}) can be reduced to allow natural regeneration and higher levels of resource flows (R_{nt+1}) and use rates (U_{nt+1}) in the next time period. In turn, higher use rates on Native areas can allow reduced use rates on Improved areas (U_{it+1}) and thus lead to increased production (R_{it+1}) and utilization (U_{it+1}) on the latter areas. Native area investments (V_{nt-1}) could have a parallel impact, except that utilization is affected directly (through θ_2) rather than indirectly through increased production.

The *potential* for increasing total utilization through range investments thus depends on physical relationships. The physical productivity of investments (α_2 , δ_2 , and θ_2) and the responsiveness of resource flows to prior use rates ($-\beta_2$ and $-\alpha_3$) are particularly important. These effects would take place sequentially; thus, one would expect the incremental magnitudes to decline the farther removed they are in time from the initial investment. The actual *realization* of increased use rates, however, depends upon the institutional and incentive frameworks of the decision maker. To the

extent that time preferences for money are strongly oriented toward the present, the potential for management flexibility which range investments afford is reduced accordingly. Higher use rates on Improved areas through new seedings, for example, offer an opportunity to allow natural regeneration on Native areas but provide no guarantee of doing so. Unless θ_s and δ_s are negative as a management strategy, the chain of causation is broken and the fruits of the investment are consumed rather than reinvested.⁸

Empirical Application

The model presented above is dynamic; estimation of parameters would require data which perhaps neither exist nor are likely to be forthcoming [11]. On the other hand, the model is highly suggestive with respect to static models which are more amenable to estimation from existing data. In the following, the authors attempt to point out the general adaptability of the theoretical model to a variety of data, including the fairly crude *ex post* data which were available for the Vale Project.⁹

The Vale Project is of significance in that substantial funds were, for the first time, made available to a public land management agency (BLM) for the purpose of range rehabilitation. Faced with grazing reductions of up to 80 percent on some allotments, political muscles were flexed prior to the 1962 election and an authorization of \$16 million was approved by Congress. The application of large sums of money to an arid area which had progressively declined in range condition led many to view the Vale Project as a significant experiment in large-scale public range investment.

Although much of the authorized amount has never been appropriated by Congress, about \$4.2 million was invested between 1962 and 1969. Foremost among the investments have been the seeding of 209,345 acres, brush control on 311,837 acres, 1,341 miles of fencing, and 193 miles of pipelines to complement 771 new reservoirs, springs, and wells. Since there are only 332 licensees on the Vale Project (59 percent of whom have less than 200 animal units), both the efficiency and distributive aspects of this undertaking are of policy significance.

⁸ This should not be interpreted as an argument for maximizing physical product, but rather as an explanation for divergency between actual and potential results of investments.

⁹ Additional details on the analysis can be found in the Godfrey dissertation [10].

Time intervals

The model is adaptable to imperfect time-related data. Due to a lack of forage data for consecutive years, data for the 1960 and 1969 grazing seasons were used to represent pre- and post-investment range productivities on the Vale Project. To the extent that the full effects of investments made late in this period are not captured by the 1969 data, these estimates understate the actual effects.

Identification of variables

Although a distinction between production (resource flows) and utilization (use rates) is basic to the model, this distinction would usually not be observable in the data except under controlled experiments. The Vale Project data, however, were adjusted by BLM range management specialists to reflect the "normal grazing capacity for livestock."¹⁰ This caused equations 6 and 8 to be "blended" for Improved areas and likewise with equations 7 and 9 for Native areas. (The implications of this will be explained under model specification.)

Units of observation

The model lends itself to experimental design or to semi-controlled conditions. Because a variety of investment alternatives was undertaken in different proportions on different allotments and at different points in time (Table 1), the Vale Project was viewed as a series of experiments under semi-controlled conditions.¹¹ Grazing allotments were selected as the unit of observation since these were the basic decision

¹⁰ The data are "normal" in that they reflect normal climatic and rainfall conditions and represent "capacity" in terms of professional judgments that these use rates would not lead to reductions in subsequent resource flows.

¹¹ Three major revegetative alternatives existed; the key variable from a management viewpoint was the extent to which the native forage (principally Bluebunch Wheatgrass, *Agropyron spicatum*) had deteriorated. If deterioration were severe, the primary practices were plowing and seeding, if the soils and topography permitted, and spraying for sagebrush control followed by seeding, if the soils and topography did not permit plowing. Seeding was generally to Crested Wheatgrass, *Agropyron cristatum*. If an adequate understory of native grasses existed, the primary practice was spraying for brush control. All three practices were followed by two years of deferment from grazing. Two other investment categories were also identified. One was the provision of supplemental fencing, water, and spraying to Improved areas which had been revegetated prior to 1960 (Old Rehab). The other was fencing and water improvements on Native areas. Both of the latter served to increase utilization of existing forage rather than production of new forage.

Table 1. Summary of Vale Project investments in the 20 allotments, 1960-1969

Practice	Acres	Direct Investment Costs	Deferred* Costs	Average Total Cost Per Acre	Normal Grazing Capacity (Acres/AUM)		Number of Allotments
					1960	1969	
Spraying	194,444	\$ 733,771	\$155,555	\$ 4.57	14.6	5.3	18
Spraying & Seeding	82,711	583,843	43,837	7.59	21.9	5.0	9
Plowing & Seeding	66,797	825,413	40,078	12.96	19.3	3.4	13
Old Rehab	41,364	101,162	0	2.45	14.9	4.7	6
Native	1,327,520	420,544	0	0.32	17.3	12.0	20
	1,712,836	\$2,664,733	\$239,470	—	—	—	20

* Deferred costs were based on costs of feeding hay at \$6.00 per AUM. Leasing private forage for \$3.00 per AUM would reduce average total cost per acre to \$4.17, \$7.32, and \$12.66 for the first three practices.

units for investment planning and determination of stocking rates.¹²

Model specification

The most basic contribution of the model is the specification of interdependence between Improved and Native areas. For purposes of measurement the form of the interdependencies will depend upon data availability. In light of the nature of the Vale Project data, two structural equations were specified in which the post-investment "normal grazing capacities" on Improved and Native areas were jointly determined. These equations represent production functions where the forage output is defined in terms of sustainable levels. In this sense they should be viewed as behavioral production functions, rather than purely biological functions, since an institutional framework is explicit in determining the upper limit to forage utilization. The two equations are:

$$(10) \quad U_{i69}^* = f(V_{i1}, V_{i2}, V_{i3}, V_{i4}, U_{n60}^*, U_{i60}^*, A_i)$$

and

$$(11) \quad U_{n69}^* = f(V_n, U_{i69}^*, U_{n60}^*, A_n),$$

where

U_{i69}^* = post-investment "normal grazing capacity" of Improved areas,

U_{n69}^* = post-investment "normal grazing capacity" of Native areas.

The five investment practices were mutually

¹² BLM grazing allotments are administrative units, each grazed by cattle owned by one or more permittees. An allotment may contain several use areas or pastures. The size of the allotments in this study ranged from 13,000 to 330,000 acres, with a mean of 83,600 acres. The 20 allotments comprised 1.7 million of the 6.5 million acres in the Vale Project and accounted for 56, 58, and 70 percent of total project investments in fencing, water developments, and rehabilitation, respectively [10].

exclusive with respect to any given treatment area and included:

V_{i1} = total investment costs for spraying,

V_{i2} = total investment costs for spraying and seeding,

V_{i3} = total investment costs for plowing and seeding,

V_{i4} = total investment costs for water, fencing, and spraying on areas initially sprayed and/or seeded prior to 1960,

V_n = total investment costs for water and fencing on Native areas.

The remaining variables included:

U_{i60}^* = pre-investment "normal grazing capacity" of Improved areas,

U_{n60}^* = pre-investment "normal grazing capacity" of Native areas,

A_i = acreage in Improved areas,

A_n = acreage in Native areas.

Preliminary simultaneous equations analysis revealed that three statistical adjustments were needed in order to estimate the model.¹³ Subse-

¹³ These adjustments were:

- The endogenous variables were measured as increases in normal grazing capacity (ΔU_i^* , ΔU_n^*) rather than absolute values. This allowed measurement error associated with the less reliable 1960 forage data to become part of the error term associated with the dependent variable, rather than causing bias in the parameter estimates.
- All variables were measured on a per acre basis instead of allowing acreages to enter as independent variables. In addition to reducing the degree of multicollinearity, this specification permitted measurement of the intensity of investment over different practices and allotments. The equations were then estimated singly even though ΔU_i^* and ΔU_n^* are still jointly dependent and a simultaneous equations bias exists.
- Intercept values for all equations were defined as zero since one would expect the normal grazing capacity,

Table 2. Regression results for range forage production functions^a

Equation	Dependent Variable	Investments					$\frac{\Delta U_i^*}{A_i}$	$\frac{\Delta U_n^*}{A_n}$	R^2	n^b
		Spray $\left(\frac{V_{i1}}{A_i}\right)$	Spray & Seed $\left(\frac{V_{i2}}{A_i}\right)$	Plow & Seed $\left(\frac{V_{i3}}{A_i}\right)$	Old Rehab. $\left(\frac{V_{i4}}{A_i}\right)$	Native $\left(\frac{V_n}{A_n}\right)$				
		α_1	α_2	α_3	α_4	β_1	α_5	β_2		
(12)	$\frac{\Delta U_i^*}{A_i}$	.0150 (1.79)	.0087 (1.20)	.0228 (4.27)	.0537 (2.40)	—	.2619 (1.33)	—	.838	20
(13)	$\frac{\Delta U_n^*}{A_n}$	—	—	—	—	.0184 (0.78)	—	.4080 (3.47)	.657	20

^a Numbers in parentheses are *t*-values of the regression coefficients.

^b Numbers of observations.

quent to these adjustments, the modified structural equations were:

$$(12) \quad \frac{\Delta U_i^*}{A_i} = f\left(\frac{V_{i1}}{A_i}, \frac{V_{i2}}{A_i}, \frac{V_{i3}}{A_i}, \frac{V_{i4}}{A_i}, \frac{\Delta U_n^*}{A_n}\right)$$

and

$$(13) \quad \frac{\Delta U_n^*}{A_n} = f\left(\frac{V_n}{A_n}, \frac{\Delta U_i^*}{A_i}\right),$$

where ΔU_i^* and ΔU_n^* reflect increases in normal grazing capacity over the 1960–1969 period rather than absolute values.

Empirical Results

Structural equations

The general consistency between the data and the relationships postulated above is evidenced by the estimates of equations (12) and (13) (Table 2). With respect to the direct effects of the various types of Improved area investments (α_j , $j=1, \dots, 4$), supplemental investments on previously seeded and/or sprayed range "produced"¹⁴ the most forage per dollar of investment input, followed by plowing and seeding, spraying, and spraying and seeding, in that order. The second-round effect [β_2 of equation (13)] was the impact of increased forage from Improved areas (regardless of source) on

Native grazing capacity. One additional AUM of Improved forage was able to generate an additional 0.408 AUM of Native forage when investment on the former made it possible to reduce grazing pressure on the latter areas.

Some evidence [α_5 of equation (12)] exists to support the argument of a third-round effect for Improved area investments, i.e., the ability to utilize increased Native forage to stimulate forage production on the Improved areas. This effect is smaller than the second-round effect and the coefficient is significant at a lower level of probability. Whether or not to conclude that a third-round effect exists, then, depends upon one's subjective judgment as to probability levels.

The evidence on a first-round effect of Native area investments is somewhat weak. Although the regression coefficient [β_1 of equation (13)] is of a magnitude comparable to Improved area investments, the significance level is low because of greater variability associated with this investment.

Marginal physical productivity estimates

If equations (12) and (13) are correct in portraying a simultaneous determination of forage increases between these two types of areas, as would be argued, the marginal productivities per dollar of investment input can be derived by differentiating the combined production function with respect to each investment type¹⁵:

as defined by the BLM, to remain unchanged in the absence of range investments and/or changes in management systems.

¹⁴ A more descriptive term would be "allowed to be utilized," since fencing and water inputs do not contribute directly to production of forage. The term "produced" is retained here for simplicity.

¹⁵ ΔU_i^* is obtained by multiplying equation (12) by A_i , multiplying equation (13) by A_n , combining the two, and rearranging terms.

$$\begin{aligned}
 \Delta U_i^* &= \Delta U_i^* + \Delta U_n^* \\
 (14) \quad &= \left[\frac{1}{1 - \alpha_5 \beta_2} \right] [(1 + \beta_2)(\alpha_1 V_{i1} \\
 &\quad + \alpha_2 V_{i2} + \alpha_3 V_{i3} + \alpha_4 V_{i4}) \\
 &\quad + (1 + \alpha_5)(\beta_1 V_n)].
 \end{aligned}$$

Then

$$(15) \quad \frac{\partial \Delta U_i^*}{\partial V_{ij}} = \left[\frac{1}{1 - \alpha_5 \beta_2} \right] (1 + \beta_2) \alpha_j$$

for Improved area investments, and

$$(16) \quad \frac{\partial \Delta U_i^*}{\partial V_n} = \left[\frac{1}{1 - \alpha_5 \beta_2} \right] (1 + \alpha_5) \beta_1$$

for Native area investments.

This formulation for Improved area investments is capable of reflecting first- ($\alpha_j = \partial \Delta U_i^* / \partial V_{ij}$), second- ($\beta_2 = \partial \Delta U_n^* / \partial \Delta U_i^*$), and third- ($\alpha_5 = \partial \Delta U_i^* / \partial \Delta U_n^*$) round effects (Table 3). As long as both area interaction terms (α_5 and β_2) are greater than zero and their product is less than one, the marginal product will extend to the third-round effect. Were α_5 zero [as might be argued from equation (12)], the marginal product would include only first- and second-round effects $[(1 + \beta_2) \alpha_j]$. If, in addition, β_2 were zero, only the first-round effect would exist. The formulation for Native area investments is also capable of showing first- ($\beta_1 = \partial U_n^* / \partial V_n$), second- ($\alpha_5 = \partial \Delta U_i^* / \partial \Delta U_n^*$), and third- ($\beta_2 = \partial \Delta U_n^* / \partial \Delta U_i^*$) round effects. Interactions between use rates and resource flows in spatially-related units thus brought about a total impact which was 57.6 and 41.3 percent greater than the first-round effects of Improved and Native area investments, respectively. The productivity ordering of investments is, of course, unchanged from the first-round estimates, since subsequent rounds involve interactions between spatial units regardless of the initial source of increased forage.

Efficiency of Investment

Modeling of the interactions between use rates and resource flows allows inferences to be made about the efficiency of public investments on the Vale Project. Inferences with respect to public range improvements in general are neither warranted nor intended. Relative to other public range lands in the West, the Vale

Table 3. Marginal physical productivities in AUM's per dollar of investment input

Practice	Cumulative Effect		
	First Round	Second Round	Third Round
<i>Improved Areas</i>	(α_j)	$[(1 + \beta_2) \alpha_j]$	$\left[\left(\frac{1}{1 - \alpha_5 \beta_2} \right) (1 + \beta_2) \alpha_j \right]$
Spray	.0150	.0211	.0236
Spray & Seed	.0087	.0122	.0137
Flow & Seed	.0228	.0321	.0359
Old Rehab	.0537	.0756	.0846
<i>Native Areas</i>	(β_1)	$[(1 + \alpha_5) \beta_1]$	$\left[\left(\frac{1}{1 - \alpha_5 \beta_2} \right) (1 + \alpha_5) \beta_1 \right]$
Water and Fencing	.0184	.0232	.0260

Project was of low productivity in its pre-investment condition (17.2 acres per AUM). As a site for experimentation in large-scale public range investments, it was identified on the basis of political forces, not on the marginal productivity of capital. Other settings in the West may well score higher on the latter scale; the methodology used in this study may be helpful in testing that hypothesis on an *ex post* basis.

The term "efficiency" is viewed here as the extent to which a stated objective is attained. While the predecessor to Senate Document 97 [13] molded the explicit objective of the Vale Project in terms of an increase in national income, the project can also be characterized by a redistributive objective. In light of the current interest in multiple objective planning [17], the following sections evaluate the Vale Project in terms of both national economic development and regional development objectives.

National economic development

Having derived MPP estimates for the various types of range improvements, it would be convenient to be able to attach a unit price to the additional AUM's and solve for the marginal value productivities. Knowledge of the latter would allow one to solve for the internal rate of return (i) on the investments, i.e., that rate which would equate the present value of investment plus deferred costs (C) with the revenue (R) stream.¹⁸ That is,

$$(17) \quad C = R \left[\frac{1 - (1 + i)^{-T}}{i} \right] [(1 + i)^{-d}],$$

¹⁸ Gardner [9] presents an excellent argument for the internal rate of return criterion and applies the procedure to several prior studies.

where f is project life, d represents years of deferment from grazing, and R equals the marginal physical productivity of the investment (F) times the value of an AUM of forage (Pa). In the absence of unit prices, solutions were derived for the value that an AUM would have to be worth (Pa) in order to yield various rates of return (r), given various assumptions about the durability of investments (Table 4). The appropriate discounting formulas are

$$(18) \quad Pa = \frac{C}{\left[\frac{1 - (1+r)^{-f}}{r} \right] F[(1+r)^{-d}]}$$

for investments with deferment from grazing (V_{d1} , V_{d2} , and V_{d3}), and

$$(19) \quad Pa = \frac{C}{\left[\frac{1 - (1+r)^{-f}}{r} \right] F}$$

for investments without deferment from grazing (V_{i1} and V_{i2}). The MPP estimates from Table 3 were used to represent F , and C was defined as \$1 to correspond to the "per investment dollar" nature of the MPP's.

Although the actual value of an AUM was not estimated, field observations indicated that \$2.50 per AUM is a reasonable approximation

Table 4. Forage values required per AUM for various interest rates and project life spans^a

Practice		Life of Investment (Years)				
<i>Spray</i>		9	12	15	25	40
Interest Rate	1%	\$4.88	3.38	2.97	1.82	1.18
	2%	5.37	4.14	3.41	2.25	1.61
	5%	6.54	5.24	4.48	3.30	2.72
	8%	7.87	6.53	5.75	4.61	4.14
<i>Spray & Seed</i>		15	18	21	30	40
Interest Rate	1%	\$5.11	4.29	3.71	2.65	2.04
	2%	5.92	5.08	4.47	3.39	2.78
	5%	7.77	6.90	6.29	5.25	4.69
	8%	9.97	9.10	8.52	7.58	7.14
<i>Plow & Seed</i>		15	20	25	40	50
Interest Rate	1%	\$1.95	1.48	1.20	0.78	0.64
	2%	2.26	1.77	1.49	1.06	0.92
	5%	2.96	2.47	2.18	1.79	1.68
	8%	3.80	3.31	3.05	2.73	2.66
<i>Old Rehab</i>		15	20	25	40	50
Interest Rate	1%	\$0.82	0.62	0.50	0.33	0.27
	2%	0.92	0.72	0.61	0.43	0.38
	5%	1.14	0.95	0.84	0.69	0.65
	8%	1.38	1.20	1.11	0.99	0.97
<i>Native</i>		15	20	25	40	50
Interest Rate	1%	\$2.67	2.03	1.64	1.06	0.87
	2%	2.99	2.35	1.97	1.41	1.22
	5%	3.70	3.08	2.72	2.24	2.11
	8%	4.48	3.91	3.59	3.23	3.14

^a Values within boxes are less than \$2.50, the estimated market value for AUM's of comparable quality, and would thus represent a superior alternative to leasing forage for private ranchers.

to market value for comparable forage.¹⁷ The values in Table 4 are thus useful for private sector decisions in the Vale Project area; ranchers can weigh those values against the leasing of private forage. For appraising the efficiency of public investment, however, comparison to values generated in the private sector has some limitations. In particular, to what private rate of return would a \$2.50 AUM value correspond? In spite of this limitation, ordinal efficiency rankings for the practices are fairly obvious, and inferences can be made about cardinal values but with less precision.¹⁸ For public sector purposes, then, the *Pa* values suggest the following:

- (a) Plowing and seeding probably yielded a rate of return in excess of that used in federal discounting at the time the project was authorized and about equal to the rate now in use. Adherents to an opportunity cost of capital would be less than satisfied with the returns from this practice, which accounted for 30 percent of total project costs.
- (b) The provision of limiting inputs (primarily water, with some fencing) to areas revegetated prior to 1960 (Old Rehab) was clearly an efficient practice, although less than 4 percent of project funds were utilized in this manner. Provision of the same types of inputs (divided about equally between water and fencing) to Native areas was both less efficient and statistically less significant. About 14 percent of total investment costs were for Native area improvements.
- (c) Long life spans and low interest rates would be required to make acceptable the two spraying practices, which accounted for 52 percent of total project costs. It should be noted that disagreement exists as to the general need for deferment from grazing following spray treatments.¹⁹

¹⁷ This value no doubt depends upon the length of use, season of year, product prices, weather conditions, and other factors.

¹⁸ Benefits other than increased livestock carrying capacity may also have resulted from the Vale Project. Reduced erosion and increased wildlife and recreation were also objectives of the project. No attempt was made to deal directly with these issues, but we would submit that much of the benefit from reduced erosion is captured by the measurement of increased forage production.

¹⁹ The need for deferment following new seedings is well recognized. Gordon Kearl, however, has drawn our attention to research in Wyoming [15] which indicates that

Fifty percent of the cost on sprayed areas (those not seeded) were for fencing, water developments, and replacement forage. If these costs could have been reduced significantly without output reductions, the efficiency of spray treatments would have increased.

- (d) The efficiency of any investment type depends in part upon project life. Some of the variability in life spans on this and other projects can be attributed to site conditions and weather. A more fundamental explanation, however, relates to interaction between use rates and resource flows. Life span is neither a predetermined nor an entirely stochastic variable but is very much a function of the intensity of use relative to natural regenerative capabilities.²⁰
- (e) The relative efficiencies of public and private sector investments depend on two forces which work in opposite directions. Private investors are faced by product price constraints not faced by public land managers. On the other hand, the stewardship role and professional training of public land managers may cause them to have both a lower discount rate and an objective function based on physical product rather than net returns. If so, the chain of causation arising from investment is extended and the eventual sustained yield utilization (Fig. 1) is higher. This tendency toward a higher payoff imposes an opportunity cost on public range users, however, since they must forego some current utilization in order to reinvest in future production.

Regional development

The new Water Resources Council guidelines [17] suggest that "benefits" and "costs" under this account should relate to positive and negative effects on regional income. Accordingly, regional development "efficiency" *vis-à-vis* these guidelines would depend on the increments and decrements to Vale area incomes as a result of the project. The decrements would

deferment on sprayed sagebrush areas has no significant effect on forage production in areas of 10 inches of annual precipitation or more. (Precipitation on the Vale Project ranges from 7 to 13 inches.)

²⁰ Incorporation of this principle into investment optimization models such as Burt's [3] would cause the use rate to be treated as an endogenous rather than exogenous variable. Bromley's comment [2] reinforces this need.

consist of investment costs by ranchers and the Vale area's share of the federal tax bill for the project.

A more interesting exercise is to look at redistributive "efficiency" in terms of regional development benefits (increases in Vale area incomes) and national economic development costs (the total value of resources required for the project). This allows one to pose the question, "Was the Vale Project a (nationally) efficient means of redistributing income toward the Vale area?" Some light can be shed on this question by Bromley, Blanch, and Stoevener's [1] input-output analysis of nearby Grant County. Their study indicated that while the incidence of a grazing reduction on federal lands would be diffused throughout the Grant County economy, the principal incidence would be on those ranchers who utilize the federal lands directly. Using an assumed 20 percent reduction in federal grazing, two earlier ERS studies [6, 16] were utilized by Bromley *et al.* to provide estimates of an 11 percent reduction (\$404,691) in gross output by the dependent ranches sector. When this reduction was traced through the input-output model, the gross output of all other sectors was estimated to decline by 1.4 percent (\$219,048). The primary incidence of a decline in household incomes was also on dependent ranches (down \$39,563, or 10.8 percent) rather than on the other sectors (down \$31,717, or .004 percent).

The inference follows from the Grant County study that dependent ranchers were the primary beneficiaries of the Vale Project. It also follows that they would have been the major "losers" had the project not been undertaken. The magnitudes associated with the latter possibility depend on whether absence of the Vale Project would have led to marginal or non-marginal changes in intra-firm and inter-firm production relationships. It should be noted that a few allottees faced federal grazing reductions of up to 80 percent at the time the project was initiated. On the other hand, the new forage produced on the 20 allotments under study was only about 25 percent of total BLM forage in the Vale District in 1964. Consequently, the

Grant County input-output model was viewed as providing a reasonable approximation to the income effects.

Had none of the range investments been undertaken on the 20 allotments under study, about 95,000 fewer AUM's would have been available.²¹ If one attaches a fairly liberal unit value of \$4.00 to these AUM's, a reduction in gross ranch output of \$380,000 was averted by the project. The associated ranch household income effect would have been about \$38,000; the income effect on all other sectors would have been about \$30,000. The total distributional benefits would thus have amounted to \$68,000 annually in terms of incomes to Vale area households. Allowing for a project life of 30 years, the present value of all future distributional benefits would amount to about \$1.5 million if discounted at 2 percent or \$1.0 million if discounted at 5 percent. Compared to total project costs of \$2.9 million, one must conclude that an explicit redistributive objective would not have been attained efficiently, from the national viewpoint, through the Vale Project. This conclusion holds even if as much as half the project costs had accrued as incomes to local households through construction activity and associated spending.

This analysis has thus indicated the inefficiency of public range investments in both the production of forage *and* the redistribution of income in the case of the Vale Project. It may well be that there are few (or even no) "efficient" means of redistributing income other than through direct income transfers if human resources are quite immobile. As long as the "work ethic" prevails, natural resource development will be looked to as a means for income redistribution toward rural areas. As a consequence, researchers need to look more closely at the redistributive efficiency of such investments in order to identify the social opportunity costs and, implicitly, the sacrifices required to maintain the work ethic.

²¹ This figure is about midway between the anticipated reduction of 98,307 AUM's and the 92,031 new AUM's produced on the 20 allotments.

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Short Articles and Notes

Legal and Economic Rights of Holders of Government Allotments*

E. C. PASOUR, JR.

Property rights of holders of tobacco and other crop allotments are explored. A decrease in demand induced by government action resulting in a decrease in allotment value is analyzed from the standpoint of a legal "taking." Such losses are contrasted with noncompensable losses due to regulatory powers of government.

THERE is currently much interest in the U. S. concerning the effect of a decline on the demand for certain agricultural commodities. This is especially true for tobacco in view of the alleged relationship between heavy smoking and lung cancer and recent actions designed to decrease tobacco demand. In 1965, for example, Congress enacted legislation which required cigarette packages to carry a health warning. In 1969 the tobacco industry agreed to remove cigarette advertising from radio and television (effective January 1971) at a time when Congress again was considering additional action to decrease the demand for cigarettes [2].¹

Numerous critics of the tobacco industry are now calling for an end to all government support to the tobacco industry. This would eliminate government funds for production and marketing research as well as the price support program (including allotments), which is dependent upon government sanctions (and, to some extent, is subsidized by federal funds). The short-run economic results might be quite pronounced for tobacco producers. Elimination of production quotas and support prices would abolish the value of allotments and result in lower tobacco and land prices. Consequently, the current holders of tobacco allotments would realize a windfall loss unless they were com-

pensated. The value of flue-cured tobacco allotments fluctuates from year to year but has decreased about 20 percent during the past several years [1, p. 9]. This decrease probably reflects the increase in uncertainty about the future of the tobacco program.²

Should holders of tobacco (or other) allotments be compensated if government action eliminates (or decreases significantly) the value of the allotment? Although this question has received little attention, many agricultural economists would probably answer it in the affirmative. Another viewpoint, however, holds that a decrease in the value of allotments is similar to many other cases of losses imposed on individuals in which a general policy of compensation is not followed [1]. Such losses (and gains) are ubiquitous since changes in relative rates of growth between various sectors of the economy are constantly occurring, reflecting shifts in demand and supply, and these changes serve to impose windfall losses (and gains) on particular individuals. Furthermore, changes in relative rates of growth between sectors are often affected by government policies.

In most cases there are no special governmental programs to compensate individuals for losses due to shifts in demand or supply, whether or not such shifts are induced by government policies. If existing legislation does not explicitly provide for compensation in the event of a loss imposed by an act of government, then the case for compensation hinges on whether the loss is a legal "taking" under the power of eminent domain. However, the case for compensation for any individual or group

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¹ The effect of this self-imposed advertising ban on the demand for cigarettes is currently a moot question. Adult per capita consumption of cigarettes in the U. S. actually increased about 2 percent during 1971 [12].

² The value of flue-cured tobacco allotments in North Carolina increased somewhat during both the 1971 and 1972 crop years. However, the current value of allotments is still below the level prevailing several years ago.

adversely affected by acts of government is often not clear-cut.

The specific objectives of this paper are to discuss the rights of holders of tobacco (and other crop) allotments, to relate this discussion to the issue of compensation, and to relate the issue of compensation to the theory of externalities.

The United States Constitution requires that private property not be taken for public use without just compensation. Hence, from a legal standpoint the question of the right to compensation by holders of government allotments hinges on the questions of whether acreage allotments are legally considered property and, if so, whether the elimination of the price support program, including allotments, is considered a "taking" in the legal sense. Consequently, the extent to which tobacco allotments are property in a legal sense is first considered. An examination of the relevant statutes is made and allotments are compared to a closely related government granted economic "privilege," *vis.*, grazing rights. The extent to which holders of crop allotments have a legally protected interest, i.e., a property right, under the power of eminent domain is then investigated. Finally, eminent domain and regulatory powers of the state are related to the modern theory of property rights involving externalities.

Are Acreage Allotments Property?

There is little evidence that Congress intended to convey the character of property to acreage allotments either in the Agricultural Adjustment Act of 1938 or in subsequent amendments to this act. In the Agricultural Act of 1938 and in subsequent amendments, acreage allotments and marketing quotas were authorized in an effort to keep the production of specified commodities in line with demand. In general the national acreage allotment for any commodity is considered the acreage adequate, together with carry-over and imports, to produce a crop sufficient for domestic, export, and reserve needs [11, pp. 27-28]. Hence, the emphasis is, and has been, on restricting production. The Agricultural Act of 1970 established a payments limitation of \$55,000 to any producer of wheat, feed grains, or cotton (for 1971, 1972, and 1973 crops). However, there was no explicit granting of property rights in allotments, even though there was increased recognition of the fact that allotments can be used as a device for dividing income transfers among producers [10, p. 165].

There is no statutory provision guaranteeing the rights of holders of tobacco or other crop allotments against losses in value. However, such allotments may be viewed as "rights" to produce. The situation is closely analogous to the case of the allotment of grazing permits to individual (private) ranchers in public domain lands and lands of the national forests.

Although it was determined early in the courts that the use of such lands is a "privilege" and not a "right," it was also determined that the use of the lands by the holder of a permit would be protected by the courts [3, p. 406]. Consequently, the real question concerns the extent of the "right" associated with the permit and not its basic existence. The example of grazing permits is closely analogous to the case of tobacco allotments because the use represented by the permit is also a valuable asset and, as in the case of crop allotments, it is rather common for the value of the permit to be capitalized into the sales price of a ranch property [3, p. 408]. Also, as in the case of tobacco allotments, provision is made for transferring the grazing permit [3, p. 427].

The case of grazing permits on public lands is not completely analogous to the case of crop allotments because the federal government is the owner of the lands to which the grazing permits apply, whereas tobacco is allotted to land which is primarily owned by individuals.³ However, a more important difference for the purposes of this paper is that grazing permits, unlike tobacco allotments, are explicitly subject to withdrawal by the federal government without compensation where necessary for governmental purposes [3, p. 427]. The fact that a tobacco allotment has a market value does not indicate the extent to which its owner has a property right in the allotment. Indeed, the Supreme Court has ruled that an economic interest, in general, is a property right only if it is a legally protected interest [8, p. 216].

The preceding discussion suggests that tobacco allotments have economic value and, hence, can be considered as property. The next question in determining the appropriateness of compensation pertains to the problem of the

³ One could cite and describe property "rights" in other cases in which the government grants rights (or privileges) to individuals to perform certain activities on federal lands. Among these are rights-of-way for power and pipe lines and permits for hotels, stores, etc. However, these examples are not as closely analogous to crop allotments as grazing permits.

extent to which such property is legally protected by the courts.

Compensation Under Eminent Domain

If acreage allotments are considered as property, when is compensation required by the constitutional provision that private property may not be taken for public use without just compensation? In cases where governments institute restrictions pertaining to or involving zoning, nuisance abatement, conservation, business regulation, pollution controls (such as the ban on DDT), and a host of other functions, courts will usually decide that the economic loss suffered by a private citizen is a mere incident of the lawful exercise of "police power" and thus is not compensable [6, p. 36]. Hence, the key issue in deciding whether a private loss is compensable is to determine if government is "taking" private property or if losses accruing to individuals are occasioned by lawful regulations.⁴

Although several approaches have been used by the courts to distinguish "takings" from losses in value due to regulations, the dominant criterion is the diminution of value theory [7, p. 151].⁵ Under this approach, the court determines the extent to which the owner's ability to profit from the property, considered by itself, has been reduced. If the profitability of the property has been severely reduced, then the property is said to have been taken and the owner is entitled to compensation. However, there are a number of examples closely analogous to abolishing the value of tobacco allotments in which total loss is left uncompensated.

⁴ The term "police power" has no exact definition but is used by the courts in identifying valid state and local government regulations which may be invoked without compensation. Although the federal government has no "police power," regulatory powers (analogous to those of the state and local governments) arise under the authority to regulate interstate commerce. There is a conflict parallel to that at the state or local levels between the federal authority to regulate without paying compensation and the demands of the Fifth Amendment [6, p. 36]. State and federal regulations are not distinguished in this paper since compensation is not required in either case.

⁵ "The other three principal approaches are: (1) the invasion theory, that makes compensation depend on whether the government has formally taken possession and title, (2) the noxious use test, which defines certain activities as socially undesirable, and therefore as non-property, and (3) the cause of the harm test, which assumes that in the case of conflicting activities between neighboring owners, one activity can be identified as causing harm to the other" [7, p. 151].

For example, government has prohibited the continuance of businesses which were lawful when established such as lotteries and liquor manufacturers. This action appears more stringent than an action which just affects the value of allotments since tobacco producers, although incurring a capital loss, would still be permitted to continue in business. Thus, there appears to be little reason to expect that the loss in value of tobacco allotments is compensable under the dominant (or any other current) legal theory of "taking."

Another consideration is that a sharp change in the legal rules might unfairly violate the expectations of the allotment holder. However, in the property rights associated with virtually any production or consumption asset, there is some risk which is influenced by government action. For example, both the profitability of housing construction and the value of housing are influenced by the federal government's monetary and fiscal policies. One can make a good argument that the purchaser of a tobacco allotment, although uncertain about the future of the tobacco program, faces no more risk as a result of unpredictable government behavior than the investor in other assets including stocks, bonds, numerous other kinds of production assets, and human capital. Furthermore, the law has often changed in ways that have had severe impacts on property owners; examples of laws banning lotteries and the manufacture of liquor were cited above.

It is sometimes stated that losses in asset values to individuals caused by shifts in supply and/or demand should not be compensable, whereas losses caused by direct government action which affects property rights should be. The preceding examples demonstrate that this distinction is untenable under current law. Furthermore, since many shifts in demand and supply are associated with or closely related to some act of government, the legal (and economic) problems posed by such a touchstone would appear to be insurmountable. Under such a criterion, losses accruing to individuals following virtually all attempts to regulate land, air, or water would be compensable.

Externalities and Compensation

The distinction between a "taking" in the legal sense in which compensation is required and exercises of noncompensable regulation is not clear-cut either legally or from the standpoint of economic theory. One view, based on a

consideration of the modern theory of property rights, is that a property owner should always be compensated when government imposes losses by restricting property rights in situations not involving externalities [7, p. 161]. Although most current government regulations involving noncompensable losses do pertain to externality situations, from a practical standpoint the presence of externalities is likely to be a matter of degree. Samuelson [5, p. 108] avers that the private goods case is a "knife-edge pole" with *all* the rest of the world involving some degree of consumption externality. If Samuelson is correct, the usefulness of the concept of externalities in determining when to compensate for losses in value of private property due to acts of government would seem to be quite limited. However, the modern theory of property rights does appear to provide a fruitful point of departure for legal and economic research concerning the proper interpretation of a constitutional "taking" in cases involving externalities.

A closely related problem pertains to the determination and adjudication of property rights between private individuals (or groups) in the presence of externalities. That is, what criteria should government use in deciding whether to impose costs upon one private party rather than another private party (or upon the public treasury)? This problem is convincingly pointed out by Samuels [4] in citing a 40-year-old court case in Virginia. The case involved the property rights of producers of red cedar trees versus the rights of apple producers whose apples were being damaged by cedar rust, a fungus which is harmless to cedar trees but which spends one phase attacking apple leaves and fruit. The Virginia Legislature "passed a statute which empowered the state entomologist to investigate and, if necessary, condemn and destroy without compensation certain red cedar trees within a two-mile radius of an apple orchard" [4, p. 436].

In this case, government was forced to choose between the interests of the two distinct groups of private property holders. Here, the feasibility or desirability of governmental action was not an issue. The government (prior to the legislative ruling), by taking no action, was effectively working to the advantage of the cedar tree producers. By passing the new law, the situation was reversed and government effectively supported the apple producers.⁶

Government in this example and in general is an instrument for the accommodation of conflicting interests. It is apparent in the cedar-apple example that there is no "common cause." Similarly, any level of government must frequently choose between interests of competing individuals or groups. Indeed, the range of activities in which individuals through government can achieve a "Pareto better" position is limited at best. One can think of few important problems in which a significant change in policy does not involve conflicting interests. Consequently, there are potential opportunities for gain by those who can use government as an instrument to secure their objectives. Of course, on any particular issue, the interests which the power of the state will be used to achieve will be determined by the relative strengths of the various conflicting interests which must be accommodated.⁷

Conclusions

The case for compensation by holders of tobacco allotments whose value is decreased by government action does not appear strong under current law. Although tobacco allotments have economic value, an economic interest is a property right only if it is legally protected. A reduction in the value of tobacco allotments due to government action does not appear to meet the necessary legal requirements to be considered a "taking." Numerous restrictions and regulations affecting property rights in land, air, and water have been imposed in recent years. Government action which reduced or abolished allotment values would appear to be closely analogous. Economic losses incurred by private citizens in connection with such restrictions are usually not compensable since such a loss is held to be a mere incident of lawful regulations.

Even though compensation for a decrease in

⁶ The question of how important neighborhood effects should be before the state should intervene is an interesting one. For example, the external costs generated by cigarette (or other) smokers in the presence of people bothered by smoke is fundamentally no different from that of the cedar-apple case. As in the cedar-apple example, by taking no action, government is effectively working to support the rights of smokers as opposed to the rights of non-smokers.

⁷ Relative strength is not merely a matter of numbers. Public regulation of public utilities in the U. S. has been widely accepted on the basis of the "natural monopoly" argument. However, Stigler [9] has shown that a regulated industry is likely to be able to use the sanctions of government operating through the regulatory agency to further its own interests.

value of allotments is not legally required, this does not mean that holders of tobacco allotments will not be compensated for significant decreases in allotment values. Specific groups of citizens, such as tobacco farmers, can use the power of the state to enhance their own interests relative to those of other groups. The de-

termination of whether special compensation is provided tobacco farmers in the event of a significant decrease in the demand for tobacco will depend on a set of political and economic forces similar to those which provided for the initial windfall gain to tobacco farmers when the program was instituted.

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Tax Loss Agricultural Investments After Tax Reform*

HOY F. CARMAN

Tax reform had differential effects on tax shelter investments in agriculture. Profits from breeding livestock were reduced, while the tax advantages of citrus and almond orchard establishment were terminated. Other orchard crops which offered tax shelter advantages before reform continue to be profitable.

INCOME tax advantages of selected agricultural investments, as well as their use and abuse by high income investors, have been well publicized. Congress, focusing on the problem, included a number of provisions affecting agriculture in the Tax Reform Act of 1969. This paper examines the impact of these new tax provisions on two popular tax-sheltered investments in agriculture—breeding livestock and orchard development.

Tax Shelter Investments

Conversion of ordinary income to capital gains is the major goal of tax-sheltered investments whether they be in apartment houses, oil and gas exploration, or agriculture. In agriculture this conversion is usually accomplished through the current deduction of what are essentially capital expenses. When the assets are later sold, resulting gains are taxed as capital gains. Cash accounting, available only to farmers, has the further advantage of permitting tax deferral. Thus, capital gains treatment and cash accounting form the foundation for tax shelter investments in agriculture. Exploitation of these provisions by investors with large nonfarm incomes attracted congressional attention, and tax reform provisions relating to agriculture were designed to control "excessive" tax-motivated farm losses by nonfarm investors.

Tax Reform Provisions

Seven of the eight tax reform provisions applicable to agriculture are concerned with tighter control over the tax treatment of farm losses.¹ These provisions include: (1) establish-

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¹ The other provision permits deferral of crop insurance

ment of an Excess Deductions Account (EDA) to recapture farm losses used to offset nonfarm income when farm property is sold, (2) recapture of soil and water conservation expenditures upon sale or disposition of land, (3) recapture of excess livestock depreciation, (4) extension of the holding period for livestock to qualify for capital gains treatment, (5) prohibition of the tax-free exchange of livestock of different sexes, (6) capitalization of planting and development costs for citrus groves, and (7) "tightening" of hobby loss rules. Examination of the application of these provisions to cattle and citrus investments demonstrates their impact.

Beef breeding cattle

Raising beef breeding cattle, one of the most popular agricultural tax shelters, was an obvious target of tax reform since four of the eight Act provisions applied to breeding livestock. Soon after passage of the Act, Black Watch Farms, Inc., a popular and well-publicized registered Angus management firm, filed for court protection under bankruptcy laws.² It appeared that tax-sheltered investments in breeding cattle had been dealt a devastating blow. Examination of a budgeted example provides an estimate of the impact of the livestock provisions and shows that there was more than just tax reform involved in Black Watch Farms' financial difficulties.³

proceeds. Tax reform provisions related to agriculture are described in [2] and [11]. Davenport [4] presents an excellent discussion of possible approaches to tax reform in agriculture together with a lawyer's evaluation of provisions of the Act. He criticizes recapture as being a complex and inferior approach to the solution of a comparatively simple problem.

² For an interesting description of the trials and tribulations of more than 500 investors who found themselves looking for homes for more than 15,000 registered Angus, see [7] and [8].

³ Recapture of excess depreciation and new capital gains rules were factors in the collapse of Black Watch Farms. In addition, it appears that the firm had management problems, cattle were seriously overpriced, a decreasing stock

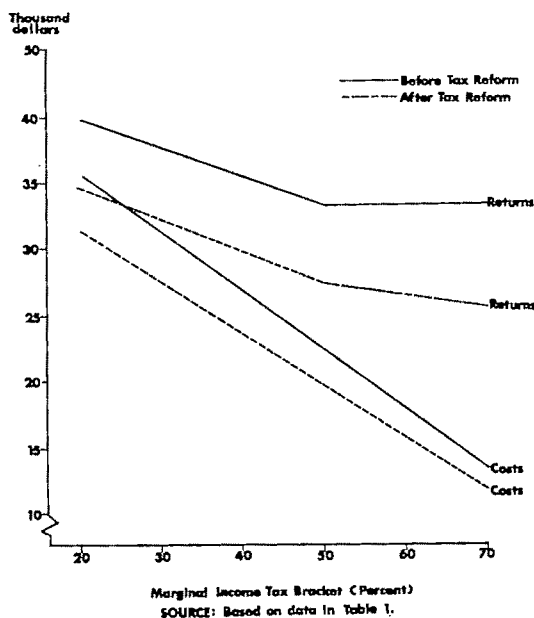


Figure 1. After-tax costs and returns for investment in a 100-cow breeding herd, by marginal income tax bracket of the investor, before and after the Tax Reform Act of 1969

A previous budget for a tax-sheltered investment in a 100-cow beef breeding herd is revised to show the impact of tax reform [1]. Recapture of excess depreciation and the one-year increase in the holding period to qualify for capital gains are the only provisions requiring budget revision.⁴ These provisions result in a redistribution of income between capital gains and ordinary income categories. Capital gains decrease \$13,752 after reform, with the recapture provisions accounting for \$2,829 of the decrease and the increased holding period accounting for the remaining \$10,923 (Table 1). The entire \$13,752 is treated as ordinary income after reform. Before tax reform all taxable income is capital gains; after reform the taxpayer also has taxable ordinary income of \$8,919 in year six of the investment.

The annual tax consequences of the investment for a taxpayer in the 70 percent marginal income tax bracket are shown for the before

and after reform situations (Table 1). Comparison of actual gains for this taxpayer reveals a decrease in returns of \$6,189, (\$19,888-\$13,699), attributable to tax reform.⁵ This 31 percent decrease in after-tax returns is applicable to taxpayers in other brackets. Computations for all tax brackets, illustrated by Figure 1, were made as follows: before tax reform returns are \$44,202 of capital gains minus capital gains tax; before tax reform costs are \$44,219 minus the product of \$44,219 and the marginal income tax bracket; after tax reform returns are \$30,450 of capital gains minus capital gains tax plus \$8,919 of ordinary income minus ordinary income tax; after tax reform costs are \$39,386 minus the product of \$39,386 and the marginal income tax bracket. Redistribution of income for tax purposes results in lower after-tax costs, lower after-tax returns, and decreased actual returns after tax reform. Annual losses are not large enough to create an EDA, and capital gains are not large enough to raise the maximum tax rate above 25 percent.⁶ Figure 1 shows that taxpayers in all tax brackets could expect positive returns from the budgeted tax shelter investment. However, changes in maintenance costs, culling rates, prices of cattle, interest rates, and calving percentage could result in losses for some or all investors even with the tax advantages. As before reform, tax advantages increase with the tax bracket of the investor. Some orchard development investments demonstrate similar tax advantages.

Orchard development

Citrus bore the brunt of tax reform applicable to orchard development. The EDA and increased capital gains tax rates will affect all large-scale orchard development, but capitalization of planting and development costs destroys tax shelter features of orchard investments of any scale. Briefly, the citrus provision requires that all expenditures for purchase, planting, cultivation, maintenance, or development of any citrus grove must be

⁵ All tax calculations are for a married taxpayer filing a joint return.

⁶ A taxpayer is required to maintain an EDA only if non-farm adjusted gross income exceeds \$50,000 for the year and farm net loss is more than \$25,000. Then, any losses in excess of \$25,000 go into the EDA. Any balance in the EDA is recaptured as ordinary income on the disposition of farm recapture property [2, pp. 187-193]. The first \$50,000 of capital gains continues to be subject to a maximum rate of 25 percent but the maximum rate on larger gains will be increased to 35 percent in 1972 [2, p. 52].

market cooled investor interest, and loan funds were very difficult to obtain [7]. Some investors who were forced to sell their cattle on the open market recovered only 10 cents per dollar invested.

⁴ The previous budget was revised to show the tax picture at the end of each year. In addition to being easier to follow, the present Table 1 is a more accurate representation of a tax shelter cattle investment.

TABLE 1
Budget for 100-Cow Investment Illustrating the Impact of
Tax Reform on Income, After-Tax Cost, After-Tax
Revenue and Net Gain or Loss for an Investor in
the 70 Percent Tax Bracket, Six-Year Projection^{a/}

End of year	Total expenses	Gross income ^{b/}				Tax picture - before reform ^{c/}				Tax picture - after reform ^{c/}			
		Before reform		After reform		Short-term loss (ordinary before tax expenses)	After-tax revenue from capital gains	After-tax cost of short- term loss	Actual gain or loss (after-tax revenue minus after-tax cost)	Short-term before tax loss (ordinary tax loss minus expenses)	After-tax cost of short-term loss	After-tax revenue from capital gains	Actual gain or loss (after-tax revenue minus after-tax cost)
		Capital gains	Ordinary income	Capital gains	Ordinary income								
1	17,372	—	4,914	—	4,914	(12,458)	(3,737)	—	(3,737)	(12,458)	(3,737)	—	(3,737)
2	11,386	705	4,329	—	4,967	(7,057)	(2,117)	529	(1,588)	(6,352)	(1,905)	—	(1,905)
3	11,583	1,499	3,744	788	4,381	(7,839)	(2,352)	1,124	(1,228)	(7,128)	(2,138)	591	(1,547)
4	12,155	1,818	5,031	1,170	5,541	(7,124)	(2,137)	1,364	(773)	(6,476)	(1,943)	878	(1,069)
5	13,460	2,190	5,850	1,552	6,488	(7,610)	(2,283)	1,643	(640)	(6,972)	(2,092)	1,164	(928)
6	15,118	37,990	12,987	26,940	21,487	(2,131)	(639)	28,493	27,854	8,919	2,676	20,205	22,881
Total	81,074	44,202	36,855	30,450	47,778	(44,219)	(13,265)	33,153	19,888	(30,467)	(9,139)	22,838	13,699

^{a/} An expanded table showing cattle numbers, cattle sales, and expense categories is available from the author. Assumptions concerning calving and culling rates, death losses, cattle prices, maintenance and management fees, and depreciation are the same as in [1].

^{b/} Income subject to capital gains taxes consists of any gain over depreciated value of purchased cows plus total receipts from cull breeding stock raised. Ordinary income consists of income from calf sales. Recapture of depreciation is treated as ordinary income for tax computations.

^{c/} The excess of total expenses over ordinary income is deductible from nonfarm income. After-tax cost is based on a taxpayer in the 70 percent marginal tax bracket. Each dollar of expenses has a real cost of only \$30. After-tax revenue is the residual sum remaining from income subject to capital gains taxes after deducting 25 percent for taxes. Parentheses denote a loss or cost.

capitalized within four years after planting. An exception is made for replanting because of casualty loss. (These provisions were subsequently extended to almonds, another popular tax shelter.) The capitalization rule applies to citrus trees planted in taxable years beginning after December 31, 1969, and to almond trees planted in taxable years beginning after December 29, 1970.⁷ Developers of other orchard crops and vineyards are not presently affected by this provision.

A budgeted example for a five-year investment in establishing a citrus orchard shows the impact of capitalization requirements and also demonstrates the magnitude of tax subsidies formerly available for citrus and almonds and still available for other orchard enterprises. The before-reform tax treatment of development expenses continues to apply to all orchard crops except citrus and almonds.

The example is operated as a tax shelter investment, i.e., the orchard is planted and maintained by an orchard management company and the established orchard is sold at the end of five years. Cost calculations do not include interest charges and taxes on land.⁸ Planting costs of \$557 per acre are capitalized and depreciated over an assumed bearing life of 35 years for both the before and after examples. Published data indicate that an established citrus orchard was worth approximately \$1475 per acre in 1969.⁹ While this figure undoubtedly varies with location, age, and condition of the orchard, it is used for these calculations.

Before reform.—Prior to tax reform, the investor could deduct depreciation, cultural costs, interest, taxes, and management fees associated with establishing the citrus orchard from other income. After the orchard was established (in this case, four years), the cost of

planting the trees was depreciable over their useful life.

For the example in Table 2, an investor would have total costs of \$1807 per acre consisting of \$541 (book value) for planting the orchard and \$1266 of other establishment costs during the five years of the investment. Since the net costs of \$344, \$334, \$332, \$220, and \$36 per acre are deductible from other income while establishing the orchard, the after-tax cost will vary with the investor's tax bracket. An investor in the 70 percent tax bracket would have an after-tax cost of only $\$921 = .3[\$1266] + \$541$, for example, while the cost to a taxpayer in the 20 percent bracket would be $\$1554 = .8[\$1266] + \$541$. Variation in after-tax costs of establishing one acre of citrus is shown by the straight line in Figure 2.

The investor has returns of \$1475 from the sale of the orchard. Since the book value of the orchard is \$541 per acre, there are capital gains of $\$934 = \$1475 - \$541$. After-tax returns will vary with the tax bracket of the investor. Those investors in the 50 to 70 percent tax brackets would pay capital gains tax of $\$234 = .25(\$934)$ and have after-tax returns of \$1241. The per-acre after-tax returns for an investor in the 20 percent bracket would be $\$1382 = \$1475 - .20[\$934/2]$. After-tax returns by marginal income tax bracket are shown by the kinked line in Figure 2.¹⁰

Comparing after-tax costs and returns before tax reform shows that taxpayers above the 42 percent marginal income tax bracket enjoyed positive after-tax returns from the investment while incurring an apparent loss of \$332 per acre. The budgeted profit for a taxpayer in the 70 percent bracket would be \$321 per acre.

After reform.—Present tax laws specify that all establishment costs for citrus and almonds (except those noted in footnote 6) incurred before the close of the fourth taxable year must be charged to the capital account.¹¹ The After Tax Reform section of Table 2 shows that this changes deductible expenses to \$95,

⁷ The text of the law can be found in Internal Revenue Code Section 278. A Treasury Regulation [1.278-1 (a) (2) (iii)] issued in 1971 provides that Section 278 of the Internal Revenue Code shall not apply to expenditures attributable to real estate taxes or interest, to soil and water conservation expenditures allowable as a deduction under Section 175 of the Internal Revenue Code, or to expenditures for clearing land allowable as a deduction under Section 182 of the Internal Revenue Code.

⁸ Any interest and taxes paid on the land would be deductible from other income.

⁹ This is the estimated value of the citrus trees only, it does not include land, irrigation system, buildings, etc. A summary of California real estate values is presented in [10].

¹⁰ The kink in the line showing after-tax returns occurs because of the maximum tax rate of 25 percent on capital gains. Beginning in 1972, if the investor has capital gains of more than \$50,000 from other sources, the kink will disappear, i.e., the slope of the line between the 20 and 50 percent brackets will continue to the 70 percent bracket.

¹¹ All establishment costs have been charged to the capital account. There is a legal question regarding the treatment of crop income; i.e., is it nominal income or does it offset costs? If crop income offsets costs, the capital account would be \$43 lower in year four than shown in the budget.

TABLE 2

Tax Deductible Costs and Book Values for A Five-Year Investment
in Citrus Orchard Establishment, Before and After Tax Reform,
San Joaquin Valley, California.

Tax deductible costs of orchard establishment	Year				
	1	2	3	4	5
	dollars per acre				
<u>Before Tax Reform</u>					
Depreciation ^{a/}					
Wind machines and heaters	22	22	22	22	22
Irrigation system	16	16	16	16	16
Trees	-	-	-	-	16
Cultural costs	181	174	174	195	207
Taxes	-	-	-	5	10
Interest ^{b/}	95	92	90	87	80
Management	30	30	30	30	30
Total Costs	344	334	332	355	381
Less crop income	-	-	-	135	345
Net costs	344	334	332	220	36
<u>Book Values (end of year)</u>					
Wind machine and heaters	418	396	374	352	330
Irrigation System	384	368	352	336	320
Trees	557	557	557	557	541
<u>After Tax Reform</u>					
Depreciation					
Wind machines and heaters	-	-	-	-	22
Irrigation system	-	-	-	-	16
Capital account ^{c/}	-	-	-	-	44
Cultural costs	-	-	-	-	207
Taxes	-	-	-	5	10
Interest	95	92	90	87	80
Management	-	-	-	-	30
Total costs	95	92	90	92	409
Less crop income	-	-	-	135	345
Net costs or (income)	95	92	90	(43)	64
<u>Book Values (end of year)</u>					
Wind machines and heaters	418	396	374	352	330
Irrigation system	384	368	352	336	320
Capital account	806	1048	1290	1553	1509

a/ Straight-line depreciation based on a useful life of 20 years for wind machines and heaters, 25 years for the irrigation system, and 35 years for trees.

b/ Calculated at 7 percent of the book value of wind machines and heaters, the irrigation system, and trees.

c/ Straight-line depreciation based on 35-year useful life for the trees.

Source: Based on budgeted costs for 40 acres planted 11' X 22', 180 trees per acre [9, p. 10].

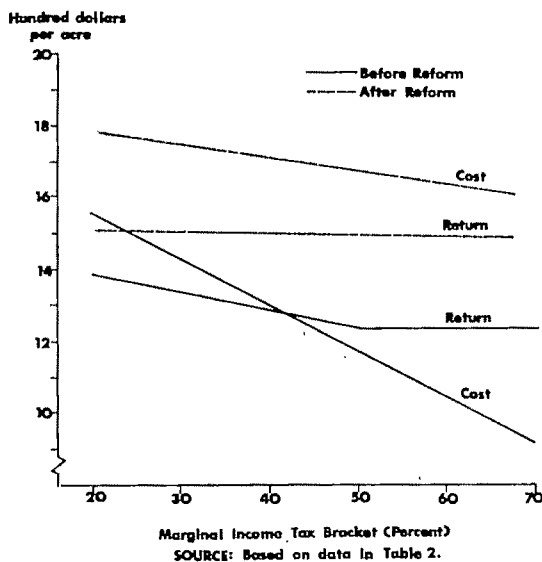


Figure 2. After-tax costs and returns for developing a citrus orchard, before and after tax reform, by marginal income tax bracket of the developer, San Joaquin Valley, California

\$92, \$90, \$92, and \$409 for years one through five. Crop income results in net ordinary income of \$43 per acre in year four and reduces the loss in year five to \$64 per acre. Total after-tax cost of the investment is the after-tax cost of \$341 = \$95 + \$92 + \$90 + \$64 plus the \$1509 in the capital account. As shown by the upper dashed line in Figure 2, it decreases from \$1782 for taxpayers in the 20 percent bracket to \$1611 for taxpayers in the 70 percent bracket.

Revenue from the investment consists of \$1475 from sale of the orchard and \$43 of ordinary income in year four. Since the book value of the capital account is \$1509, the investor will have a capital loss rather than a capital gain.¹² After-tax income varies from \$1509 for taxpayers in the 20 percent bracket to \$1488 for taxpayers in the 70 percent bracket as shown by the lower dashed line in Figure 2. Comparison of costs and returns reveals that losses range from \$273 to \$123 per acre after reform.

Reduction in development subsidy.—The increase in costs of citrus development due to changes in tax laws can be estimated by comparing the before and after tax reform budgets in Table 2. This increase in costs provides an estimate of the reduction in the development subsidy but does not measure total subsidies.

¹² The effect of this capital loss on total income tax liability is not considered.

One could argue that small tax subsidies are still available for development of citrus and almonds.

The estimated decrease in subsidy for a five-year tax shelter investment is calculated by adding after-tax reform losses to before-tax reform profits. For a taxpayer in the 70 percent bracket, the decrease in subsidy is \$444 where before-reform profit was \$321 and after-reform loss was \$123 per acre. All investors were subsidized but the amount per acre increased rapidly with income tax bracket (Fig. 3).

The reduction in tax subsidies to producers who maintained citrus trees throughout their bearing life was also substantial as shown in Figure 3. The additional \$996 deductible as a current expense before reform provided an immediate tax saving to the producers. For example, a 39-year investment was examined in terms of present values at the end of the fourth year. The reduction in subsidy for a taxpayer in the 70 percent marginal tax bracket was calculated as follows: the additional current deduction of \$996 saves \$697 of taxes. Add to this \$142, which is the present value of a 35-year annuity of \$11 (70 percent of the annual depreciation for trees) at 7 percent interest. Present value of tax deductions before reform thus totaled \$839. After reform the producer has an annual deduction from the capital account of \$44 per acre which saves \$31 in taxes. Present value of a 35-year annuity of \$31 at 7 percent interest is \$401. The difference between \$839 and \$401, \$438 per acre, is the reduction in subsidy for a producer-developer who maintained the orchard through its bearing life.

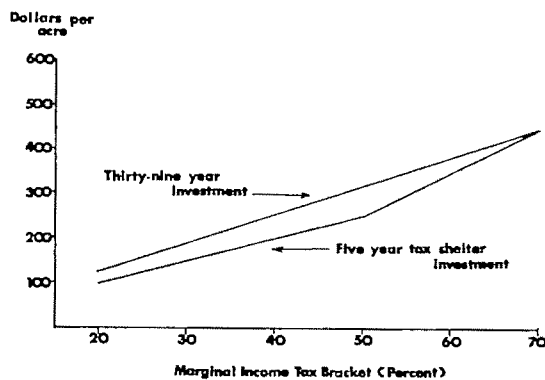


Figure 3. Decreases in tax subsidy for developing citrus orchards due to tax reform, five-year tax shelter investment and 39-year investment, by marginal income tax bracket of the developer, San Joaquin Valley, California

While the amount of subsidy varies by crop because of differences in establishment costs and values of standing orchards, the pattern illustrated in Figure 3 presently exists for orchards other than almonds and citrus. The advantage of currently deducting what are essentially capital costs is substantial, even for those orchard crops which are not profitable as a tax shelter investment.

Probable Impact of Tax Reform

Tax shelter investments in agriculture were an obvious target of the Tax Reform Act of 1969. But, as shown, effects of the various provisions are mixed. The recapture features of the EDA were billed by some as "demolishing tax shelters" in agriculture [2, p. 187]. However, this provision has no effect on small and medium-sized investments because it applies only to losses in excess of \$25,000 in a tax year. The overall effect of the EDA will be small since previous studies reveal that less than 1/2 percent of tax returns showing farm losses have a combination of losses over \$25,000 and non-farm income over \$50,000 [4, p. 348].

Decreased tax shelter advantages for livestock investments will have several effects, but in aggregate they are probably small. There will probably be a slight increase in ranchers' tax liability due to the increase in the holding period to qualify for capital gains treatment. A decrease in breeding cattle ownership by non-farm investors with an accompanying decrease in capital available to ranchers is likely. Oppenheimer Industries, Inc., a large cattle management company, reported a 17 percent decrease in their cattle management business during the year following passage of the Act. Herd numbers declined from 148,000 in 1969 to 122,000 in 1970 [6, p. 1]. Ronald Jarvis, Jr., president of Oppenheimer Industries, Inc., wrote that his firm normally channels more than \$20 million annually into agriculture through its various cattle programs [5]. In 1970 this dropped to a little more than \$13 million.¹³

Tax shelter advantages of establishing citrus groves and almond orchards have been terminated by tax law changes. In addition, the tax subsidy formerly available to all developers of

these two crops (farmers and nonfarm investors) has been substantially reduced. If tax shelter developments of these two crops were important, one could expect a decrease in the rate of new plantings as investor interest shifts to other enterprises or to orchards with a large capital account available for depreciation.

For all other orchards and vineyards, tax subsidies exist virtually undisturbed by reform. High income investors (and farmers) continue to enjoy substantial tax advantages over low income investors in developing orchards and vineyards. Tax shelter investments in orchard or vineyard establishments which were profitable before tax reform continue to be profitable when pursued on a small to medium scale. Large tax shelter investments may offer slightly lower profits if there is a balance in the EDA or if more than \$50,000 in capital gains is realized in a tax year. In California there seems to be continued and, perhaps, increased interest in developing pistachios, walnuts, wine grapes, and kiwi fruit.¹⁴

It is obvious that even after reform tax laws are not neutral with regard to resource allocation in agriculture. The problem of continued tax subsidies for orchard development deserves attention. Are subsidies desirable, given inelastic demands and surplus production for some orchard crops? An apparent conflict in policy is the tax subsidies for establishing cling peach orchards and a state market order program which includes a green drop and tree removal.

Concluding Remarks

This article considers only a few of the many income tax provisions affecting agriculture. It concentrates on examining the impact of recent changes in federal income tax law with emphasis on tax shelter investments in agriculture. The results suggest that tax reform has had mixed effects on tax loss farming with variation by type and size of the investor's investment, income, and manner of operation. Livestock and some orchard crops continue to offer tax shelter advantages to the careful investor, but establishment of almond orchards or citrus groves is no longer profitable from a tax standpoint.

Alternative income tax provisions can affect agriculture in different ways. As an illustration,

¹³ All of this decrease cannot be attributed to tax law changes. Jarvis [5] also cites the collapse of Black Watch Farms, an unfavorable stock market, and depressed conditions in the entertainment industry as factors in the decrease.

¹⁴ See, for example, a recent article which describes some of the advantages (including tax) available for pistachios [3].

tax subsidies can be used to encourage investment in agriculture, increase output, and, perhaps, maintain low farm prices and incomes. If the goal is to raise farm income, tax subsidies may be inappropriate, especially for products with inelastic demand. Tax provisions can also

influence the demand and price for land and other inputs and the level of conservation expenditures. Thus, changes in tax provisions affecting agriculture should be examined to ensure their compatibility with agricultural policy goals.

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Evaluation of Local Nonproperty Taxes For Rural and Urban Areas in Kansas*

FRANK ORAZEM AND RONALD G. TROSTLE

Average per capita property tax base in Kansas is almost three times higher in rural areas than in urban areas, while per capita nonproperty tax bases (income and sales) are higher in urban areas. While local nonproperty taxes may not be panaceas for either rural or urban areas, their use has greater potential in an urban than in a rural setting.

THAT local government expenditures have been increasing rapidly is well known, and the resulting increase in local revenue requirements has strained many local revenue systems. Federal and state aid have increased, but not enough to stem rising pressures on local public finance. Local nontax revenue has also increased, but it generally is earmarked to finance specific public services. Hence, the tax structure at the local government is left with the task of obtaining much more revenue. Traditionally, the tax structure of local governments, to the taxpayers' dissatisfaction, has relied almost entirely on the property tax. In many localities the property tax base grows slower than does the demand for public services. Equity is another reason for increasing dissatisfaction with the property tax. The dissatisfactions have been manifested by the organization of taxpayer associations, by persons paying property taxes under protest, and by several state courts deciding that the local property tax, as now used to finance education, may be unconstitutional. Local governments are searching for new sources of revenue over which they have control [4, p. 109].

A Typical Situation

Kansas offers a somewhat typical illustration of both the process by which local nonproperty tax legislation occurs and the form it takes. Kansas localities have traditionally relied on the property tax to finance local government services. Dissatisfaction with it has become more widespread and more intense.

Individuals and groups representing the various sectors of Kansas society who voice dissatisfaction usually list two primary grievances. First, effective property tax rates have reached

the highest limits acceptable, but existing methods of local government finance make further increases inevitable. Second, the property tax no longer distributes the tax load equitably. The property tax is too burdensome for some, while it does not represent the full ability of others to finance their local government. Because the property tax was high and violated the principle of horizontal equity, its domination of the local tax structure no longer seemed acceptable.

Reluctance of property taxpayers gave impetus to the so-called "property tax lid" bill passed during the 1970 session of the Kansas Legislature. It limited property tax levies and operating budgets of counties, cities, school districts, and junior colleges, and authorized counties or cities to use local income and sales taxes, subject to voters' approval, to help finance operations of their local governments.

To date only three cities have added a nonproperty tax to their tax structure. A few others are considering such action, but the majority apparently have not even considered the possibility.

Why has what appeared to be widespread dissatisfaction with the property tax failed to cause more nonproperty taxes to be enacted? Is it possible that the authority to levy nonproperty taxes does not increase the number of feasible alternative revenue sources for local governments?

Individual Locality Analysis of Nonproperty Tax Alternatives

Historically, nonproperty taxes have been used in urban rather than rural areas. Geographical distribution of states with local income taxes confirms this phenomenon. Of 13 states with local income taxes, 10 are in the more populous eastern half of the United States [1, p. 2; 7, p. 8]. A local sales tax also tends to be found in the more populous states or in large cities. In some states nonproperty taxes are allowed only in municipalities with populations

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greater than a specified minimum size [9, p. 57]. However, even in states that allow any or all of their localities to levy nonproperty taxes (as Kansas does), the tendency is strong to use nonproperty taxes only in urban areas [5, p. 133; 2, p. 95]. Why are nonproperty taxes not used in rural areas?

It was hypothesized that the effects of nonproperty taxes differ widely between rural and urban areas. In urban areas, adding a nonproperty tax may change the distribution of the tax load so that the total tax structure better reflects each taxpayer's ability to pay taxes. It may also significantly increase the revenue-generating ability of the tax structure. However, in rural areas a nonproperty tax has neither of these effects.

Equity considerations were examined first. Traditional arguments supporting the property tax declare that wealth is not merely income producing but represents a measure of overall ability to pay taxes. However, it may be that as the economic structure of society becomes less agricultural, the ability to pay will not be so well represented by property ownership as it was previously. As a locality becomes more urban, there may be a breakdown in the relationships between property value, property income, and other measures of the ability to pay taxes.

To begin a test of the hypothesis, the relationship between total income (I) and property income¹ (PI) [8, pp. 51-54] was examined in rural and urban counties.² Equations³ (1) and (2) show that the relationship is highly significant statistically in rural (R) but not in urban (U) counties.

$$(1) \text{ Group } R: I = 1,450 + 1.77 PI, R^2 = .71 \quad (6.1)^*$$

$$(2) \text{ Group } U: I = 3,135 - 0.29 PI, R^2 = .04. \quad (-0.2)$$

Equations (3) and (4), which deal with the relationship between total income and value of property owned (PV), give additional support to the hypothesis.

$$(3) \text{ Group } R: I = 2,066 + .0285 (PV), \quad R^2 = .76 \quad (6.4)^*$$

$$(4) \text{ Group } U: I = 3,079 - .0065 PV, \quad R^2 = .04. \quad (-0.2)$$

In both sets of equations the explanatory power (R^2) of the equation is greater for Group R than it is for Group U . More important, however, are the differences in the coefficients and intercepts of the equations. Figures 1 and 2 indicate the slopes, levels, and relevant ranges of the regression equations for Group R and Group U .

A related observation is that property income makes up 27.9 percent of total income for Group R but only 16.1 percent for Group U [10, p. 79]. In rural areas agriculture is the predominant economic activity, and it requires large capital investments in taxable property. Industries in urban areas are also involved in production. Although taxable property and property income may have the same relationship in the rural and urban areas, taxable property makes up a smaller percentage of the economic base in urban areas largely because many urbanites are involved in service-type industries that require major investments in education and training.

Equity considerations require a similarity of circumstances among individual taxpayers in a taxing district that relies on a single tax. In a situation where the taxpayers are relatively

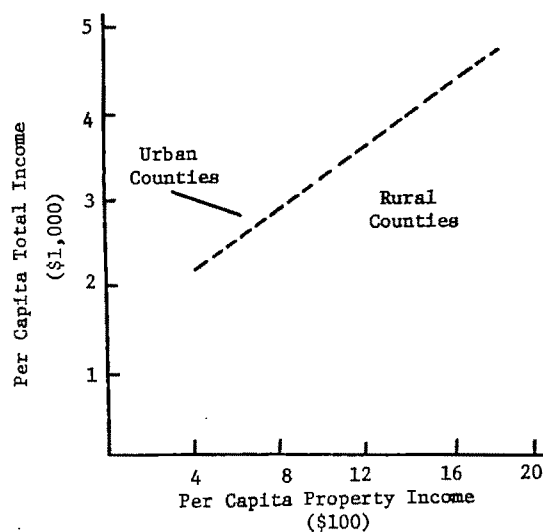


Figure 1. Relationship between total income and property income in rural and urban counties

¹ Property income includes income in the form of rents, dividends, and interest. For estimating procedure see [3, p. 45].

² The 105 Kansas counties were divided into three groups: Group R , the most rural (31), Intermediate (41), and Group U , the most urban (33) [1, p. 78].

³ Computed t -values are in parentheses below the coefficients. The asterisk denotes significance at the .01 level.

homogeneous (farmers), a single measure of ability to pay and, consequently, a single tax may give reasonably equitable results. However, in urban areas persons tend to have a wide variation in wealth, sources of income, consumption patterns, education, and other factors affecting the ability to pay taxes. In such a nonhomogeneous environment a single tax cannot be expected to capture the many factors that determine the ability to pay taxes.

In summary, ownership of property is a more accurate measure of resources and of the ability to pay taxes in rural areas than it is in urban areas. This is true regardless of whether ability to pay is measured in terms of wealth, income generated by that wealth, or total income. In a rural area, property ownership may still be the best overall measure of ability to pay. In an urban setting, however, relationships between property ownership and ability to pay taxes are less clear.

Revenue-Generating Ability of Nonproperty Taxes

The average per capita property base in Kansas is almost three times as high in rural areas as in urban areas (\$32,582 vs. \$11,994) [10, p. 79]. The per capita nonproperty tax bases, on the other hand, are higher in urban areas.

Because nonproperty bases relative to the property tax base are smaller in rural areas, nonproperty tax rates required to raise adequate amounts of local revenue efficiently in those areas would seem unreasonable to most. Nonproperty tax rates authorized by Kansas (1 percent sales and 2 percent local income tax) would generate relatively little revenue in rural counties. For example, in 1970 a 1 percent local sales tax would have increased local revenue by only 1.3 percent in a rural county but 15 percent in an urban county.

Rural counties such as Chase, Clark, Hodgeman, Jewell, Kearney, Meade, Stafford, and Stevens would have needed more than double the current state sales tax of 3 percent to raise an equivalent of 10 percent of property taxes in 1970. On the other hand, in counties like Barton, Crawford, Ellis, Finney, Ford, Geary, Neosho, Riley, Saline, Sedgwick, and Shawnee in 1970, a local sales tax of less than 1 percent would have brought revenue equivalent to 10 percent of property tax collections in that year [6, pp. 225-238].

Similarly, the revenue generated by a 2 per-

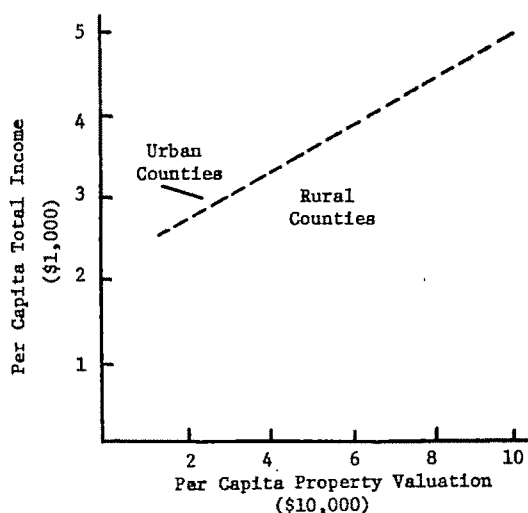


Figure 2. Relationship between total income and property valuation in rural and urban counties

cent local income tax would have increased local revenue in 1970 by 15.8 percent in an urban county but by only 3.8 percent in a rural county. In only 17 out of 105 counties would a 2 percent local income tax exceed 10 percent of 1970 counties' property tax collections [6, 220-225]. In only 10 counties would a 1 percent sales tax yield greater revenue than the 2 percent local income tax. Each of these 10 counties has an important trade center. The revenue-generating ability of local income or local sales taxes is much greater in urban than in rural localities. A local nonproperty tax in a rural locality appears to be a weak alternative.

Conclusions

Adding a local nonproperty tax will have two important effects in urban areas that may not occur in rural areas. First, it likely will change the distribution of the tax load so that the total tax structure better reflects each taxpayer's ability to pay taxes. Second, it will significantly increase total tax revenues. Evidence in this study indicates that neither of those effects will occur in rural areas of relatively homogeneous taxpayers.

Although some states in response to widespread demand for a "fairer" and more productive local tax structure have passed legislation to allow local nonproperty taxes in all localities, the implication for rural areas is clear. A local nonproperty tax will significantly increase

neither equitableness nor revenue productivity of the rural tax structure. Thus, authorizing use of nonproperty taxes will not increase effective alternatives to property taxes.

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Analysis of the Accuracy of USDA Crop Forecasts*

G. GUNNELSON, W. D. DOBSON, AND S. PAMPERIN

Accuracy of USDA crop forecasts increased moderately over the 1929-1970 period. However, USDA's first forecasts of crop production tended to underestimate crop size and the size of year-to-year changes in production. USDA also undercompensates for errors in earlier forecasts when developing revised crop forecasts.

THIS study represents the initial step in a larger study devoted to evaluating the adequacy of existing agricultural information systems and developing possible ways of restructuring the systems to meet emerging needs of management.¹ The present article examines the accuracy of more than 1,100 USDA crop production forecasts for barley, corn, oats, potatoes, soybeans, spring wheat, and winter wheat for the period 1929-1970. The study measured whether USDA crop forecasts improved upon the accuracy of information available from earlier forecasts, exhibited increased accuracy under favorable forecasting conditions (e.g., stable conditions), and were free of systematic error or "bias." A current evaluation of the accuracy of the crop forecasts appears useful since farmers, agribusiness firms, and government agencies make decisions involving billions of dollars annually [7, p. 11] on the basis of the forecasts, and deficiencies in the forecasts may cause undesired effects on plans and resource allocation. The results also may provide USDA with information useful in deciding what changes, if any, are needed in crop forecasting procedures to meet user requirements.

The study differs in several respects from

earlier research on the subject by Baker and Paarlberg [1, 2] and Clough [4]. First, a different evaluation technique developed by Theil [6, p. 62] was employed which simplified identification and classification of the types of errors which appear in the USDA crop forecasts. Second, the study examines the accuracy of USDA forecasts for several crops not considered in earlier studies. Finally, the analysis was based on data for a longer period (42 years) which permitted an evaluation of forecasting accuracy by subperiod to determine whether the accuracy of USDA forecasts has improved over time.

Scope of Study and Criteria for Evaluating Accuracy

The Crop Reporting Board of the USDA collects information used to develop crop forecasts by mail surveys of farmers, supplemented by probability samplings, enumerative surveys, and objective measurement of crop yields.² The annual cycle of crop forecasts issued by the USDA begins with reports of farmers' planting intentions (issued in March for crops such as corn and oats), followed by several production forecasts (typically beginning in July) based on acreages actually planted and expected yields, and ends with estimates of harvested acreages, production, and disposition of the crops. In this study the accuracy of the first production forecasts and the subsequent revisions for seven crops was examined for the 42-year period of 1929-1970. No attempt was made in the study to examine the accuracy of USDA intentions reports or disposition estimates.

The accuracy of USDA crop forecasts was evaluated according to the following criteria:

1. A given forecast should improve upon the accuracy of information contained in previous forecasts that were developed on the basis of less information.
2. Forecasting error should be smaller for crops with shorter forecasting periods and under conditions when crop production changes

² See [7] for a more detailed description of procedures used by USDA for developing crop forecasts.

* Portions of the results reported here were obtained by G. Gunnelson while employed as an agricultural economist in the Marketing Economics Division, U. S. Department of Agriculture. Financial support for the research also was obtained from Hatch Project No. 1686, University of Wisconsin, Madison. Helpful comments by A. C. Johnson, Jr., J. Schmidt, and *Journal* reviewers are gratefully acknowledged.

¹ The larger study being conducted at the University of Wisconsin also involves development of data banks and price forecasting models which will provide inputs required by computerized decision models and analysis of commodity production cycles within the Industrial Dynamics framework.

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relatively little from year-earlier levels. Revised crop forecasts also should be more accurate than earlier forecasts.

3. Forecasts should be free of systematic error or "bias."

For purposes of evaluating accuracy of the crop forecasts according to the three criteria, error was defined as the difference between the early forecasts and the December revised estimates of production which the USDA issues one year after the December final estimates. Early forecasts are developed by USDA under a set of assumptions which normally will produce errors in the forecasts if growing conditions deviate substantially from average after the forecasts are issued. For example, the USDA July spring wheat production forecast is based on July estimates of acreage for harvest and the condition of the crop at the time and assumes that normal growing conditions will prevail until harvest time. Thus, the July spring wheat forecast may fail, *ex poste*, to predict production accurately if growing conditions depart substantially from normal after it is issued. In the study it was not feasible to separate error caused by condition changes—unavoidable error given USDA's forecasting procedures—and error caused by other factors over which USDA has control. Despite this problem, it was possible to measure approximately how much USDA's forecasting performance has improved over time by comparing forecasting accuracy for several 10-year subperiods. Changes in forecasting accuracy over subperiods should reflect the effects of changes in techniques and forecasting skill since the effects of the essentially random condition changes should have remained relatively constant from one subperiod to another.³

Performance Tests Employed

Criterion No. 1: accuracy improvement

Two analyses were made to determine whether USDA forecasts improved upon the accuracy of existing information. First, the initial crop production forecasts for the year (e.g., the July corn production forecast) were compared to actual crop production for year_{t-1} to determine whether the first forecasts predicted production more accurately than the

naive forecasts based on actual production for year_{t-1}. Second, two revised crop forecasts for each year (e.g., the August and September corn forecasts) were compared to the immediately preceding forecasts (e.g., the July and August corn forecasts) to determine whether these forecasts were more accurate than the immediately preceding ones.

Theil's *R* statistic, or revision ratio [6, p. 62], was employed to determine if a given USDA crop production forecast improved upon existing information. This ratio is written as

$$R = \frac{F_t - F_{t-1}}{A_t - F_{t-1}}$$

where:

F_t = current forecast,

F_{t-1} = previous forecast, and

A_t = actual production.

Values obtained for the *R* statistic identify various types of errors in the forecasts. For a given comparison of F_t and F_{t-1} , if $0 < R < 2.0$, this indicates that the current forecast is nearer to actual production than the previous forecast. A perfect current forecast would result in an *R* value of 1.0. Comparisons in which $0 < R < 1$ and $1 < R < 2.0$ result when current forecasts F_t undercompensate or overcompensate, respectively, for the error in the previous forecast F_{t-1} . However, when $0 < R < 2.0$ the undercompensation or overcompensation is sufficiently small that F_t is a more accurate predictor of A_t than is F_{t-1} . For example, if both F_t and F_{t-1} underestimated crop size, but F_t was nearer to A_t than was F_{t-1} , then $0 < R < 1.0$. Similarly, if F_{t-1} underestimated crop size and F_t overestimated crop size but F_t was nearer to A_t than was F_{t-1} , then $1.0 < R < 2.0$. In the results section satisfactory forecasts are referred to as those for which $0 < R < 2.0$.

Unsatisfactory current forecasts are indicated when the comparison of F_t and F_{t-1} produces results in which $R < 0$ or $R > 2.0$. Negative *R* values identify what are designated as turning point errors. This type of error results, for example, when F_t underestimates A_t by more than did F_{t-1} . If $R > 2.0$, this represents an overcompensating adjustment (in the correct direction) which results in F_t being farther from A_t than was F_{t-1} . Thus, if F_{t-1} underestimated crop production and F_t overestimated crop production by more than F_{t-1} underestimated production, the resulting *R* statistic for the comparison would be greater than 2.0.

³ This assumes that in each of the subperiods examined the size and frequency of the errors caused by changes in growing conditions after issuance of the early forecasts were similar. Such an assumption may not have been appropriate for the 1929-1938 subperiod when drought conditions during several growing seasons were severe.

Criterion No. 2: accuracy and forecasting conditions

For purposes of this study three conditions were specified that USDA forecasts should meet in order to exhibit increased accuracy under the forecasting conditions specified under Criterion No. 2. First, absolute forecasting error should be lower for crops for which the forecasting time span is shortest.⁴ Thus, the first production forecast for oats with a July-October forecasting period should be more accurate than the first forecast for corn with the longer July-December forecasting period. Second, for a given commodity absolute forecasting error associated with succeeding revisions should be less than for earlier forecasts. Third, absolute forecasting error should be lowest when variability of production (year-to-year change) is smallest.

Criterion No. 3: detection of systematic error

Measurements to detect systematic error or "bias" consisted of examining the extent to which USDA's first crop production forecasts underestimated annual crop production and the extent to which first production forecasts underestimated the amount of year-to-year change in production.

Results

Accuracy improvement

The first crop production forecasts and the revisions issued by USDA generally were more accurate than earlier forecasts (Table 1). About 70 percent of the first forecasts were more accurate than estimates based on actual production for the previous year (see Table 1 values for $0 < R < 2.0$). The percentage of satisfactory first forecasts ranged from 61.0 for corn to 75.6 for potatoes. However, about 62 percent of the satisfactory first forecasts underestimated the amount of change in production from year-earlier levels. The unsatisfactory first forecasts consisted almost equally of those which exhibited turning point errors, $R < 0$, and those which correctly indicated the direction of change in

⁴ Generally, USDA forecasts for commodities with short forecasting periods should be more accurate since during the shorter forecasting time intervals for these crops there is less chance for things to happen which could adversely affect the accuracy of the predictions. It is true of course that factors such as the rate at which the crop matures also could influence the expected accuracy of forecasts for crops with short forecasting periods, compared to those with longer forecasting periods.

Table 1. Distribution of R statistics comparing accuracy of first, first revised, and second revised crop production forecasts to accuracy of earlier crop forecasts, by commodity, 1929-1970

Forecast and Commodity	Percentage of R Statistics				
	<0	0-1.00	1.01-2.00	>2.00	0-2.00
First Forecast:					
Barley (July) ^a	12.2	43.9	29.3	14.6	73.2
Corn (July)	26.8	43.9	17.1	12.2	61.0
Oats (July)	17.1	48.8	22.0	12.2	70.8
Late Potatoes (Aug.)	14.6	51.2	24.4	9.8	75.6
Soybeans (Sept.) ^b	20.0	30.0	40.0	10.0	70.0
Spring Wheat (July)	14.6	39.0	31.7	14.6	70.7
Winter Wheat (April)	12.2	48.8	19.5	19.5	68.3
Seven Commodities	16.8	43.7	26.3	13.3	69.9
First Revision:					
Barley (Aug.)	9.5	76.2	9.5	4.8	85.7
Corn (Aug.)	28.6	50.0	14.3	7.1	64.3
Oats (Aug.)	19.0	47.6	21.4	11.9	69.0
Late Potatoes (Sept.)	21.4	64.3	9.5	4.8	73.8
Soybeans (Oct.) ^b	22.6	67.7	6.5	3.2	74.2
Spring Wheat (Aug.)	21.4	61.9	7.1	9.5	69.0
Winter Wheat (May)	35.7	57.1	2.4	4.8	59.5
Seven Commodities	22.6	60.7	10.1	6.6	70.8
Second Revision:					
Barley (Sept.)	19.0	64.3	9.5	7.1	73.8
Corn (Sept.)	14.3	69.0	7.1	9.5	76.1
Oats (Sept.)	35.7	47.6	14.3	2.4	61.9
Late Potatoes (Oct.)	19.0	66.7	11.9	2.4	78.6
Soybeans (Nov.) ^b	19.4	67.7	9.7	3.2	77.4
Spring Wheat (Sept.)	14.3	64.3	11.9	9.5	76.2
Winter Wheat (June)	35.7	42.9	9.5	11.9	52.4
Seven Commodities	22.5	60.4	10.6	6.6	71.0

^a Months in parentheses indicate the time when forecasts were issued. To ensure comparability of figures over the years, first forecasts which were issued for only a portion of the period studied (e.g., the June first forecast for barley issued from 1941-1951) were excluded from consideration in the study.

^b Computations made from data for 1940-1970 for soybeans.

production from year-earlier levels but which erred by more than did the forecast based on production for the previous year, $R > 2.0$. The respective percentages for the two types of errors are 16.8 and 13.3. For the individual crops, the first forecasts for corn exhibited the lowest percentage of satisfactory forecasts, owing chiefly to the relatively large percentage (26.8) of turning point errors.

USDA revised forecasts more accurately predicted crop size than earlier forecasts in about 70 percent of the cases (Table 1). The percentage of successful first revisions ranged from 59.5 percent for winter wheat to 85.7 percent for barley. USDA forecasts for winter wheat also exhibited the lowest percentage of satisfactory second revisions (52.4 percent). The largest percentage of successful second revisions was recorded for potatoes (78.6 percent). While a relatively high percentage of the revisions was successful, the revised forecasts tended to undercompensate for the error in the previous estimate. Thus, for example, if first crop forecasts underestimated or overestimated

Table 2. Distribution of *R* statistics comparing accuracy of first, first revised, and second revised crop production forecasts to accuracy of earlier crop forecasts, seven commodity averages, by subperiod 1929–1970

Forecast and <i>R</i> Statistic Ranges*	R Statistic Distributions by Subperiod				
	1929–1938	1939–1948	1949–1958	1959–1968	1969–1970
	(Percentages)				
First Forecast:					
<0	10.2	14.7	21.7	11.6	50.0
0–1.00	49.1	47.1	37.7	49.3	21.4
1.01–2.00	30.5	19.1	26.1	27.5	14.3
>2.00	10.2	19.1	14.5	11.6	14.3
0–2.00	79.6	66.2	63.8	76.8	35.7
First Revision:					
<0	25.0	24.6	21.4	20.0	21.4
0–1.00	55.0	63.8	64.3	57.2	64.3
1.01–2.00	13.3	8.7	8.6	11.4	7.1
>2.00	6.7	2.9	5.7	11.4	7.1
0–2.00	68.3	72.5	72.9	68.6	71.4
Second Revision:					
<0	28.4	21.7	21.4	20.0	21.4
0–1.00	55.0	56.5	65.7	61.4	64.3
1.01–2.00	8.3	13.1	7.2	12.9	14.3
>2.00	8.3	8.7	5.7	5.7	0.0
0–2.00	63.3	69.6	72.9	74.3	78.6

* *R* statistics computed using data for 1940–1970 for soybeans and data for 1929–1970 for other commodities.

crop size, the first revision was likely to exhibit similar characteristics. Turning point errors accounted for nearly 80 percent of the unsuccessful first and second revisions. This is perhaps to be expected since as the difference between the forecast and actual crop size diminishes forecasting involves finer adjustments. This condition increases the probability of this type of error.

Distributions of the *R* statistics by subperiod for the seven commodities as a group appear in Table 2. The highest percentage (79.6) of satisfactory first forecasts was obtained during 1929–1938 and the lowest percentage during 1969–1970. Of course, few generalizations can be drawn from the figures for 1969–1970 about USDA's forecasting performance since the number of observations during the subperiod is small and unusual conditions (e.g., corn blight) existed during the period. Moreover, the percentage of satisfactory first forecasts did increase during 1959–1968 to 76.8 percent or by 13 percent over the comparable figure for 1949–1958. This may indicate that the accuracy of the first forecasts has improved moderately in recent years.

Stronger evidence of improved forecasting performance appears in the second revisions. For these figures the percentage of satisfactory forecasts increased from 63.3 percent in 1929–1938 to 74.3 percent in 1959–1968. However, the percentage of successful first revisions re-

mained relatively constant at about 70 percent. It is evident also that for the successful first and second revisions, the earlier mentioned tendency to undercompensate for error in the earlier estimates has persisted without much change over time.

Accuracy and forecasting conditions

USDA forecasts generally exhibited desirable properties as judged by Criterion No. 2. Absolute forecasting error for the 1929–1970 period generally was lower for commodities with shorter forecasting periods (Table 3). Corn, for example, which has a forecasting period extending from July to December, exhibited a forecasting error of 9.2 percent for the first forecast, compared to 4.9 percent for oats with the shorter July–October forecasting period. An exception exists for the forecasts for spring wheat. Absolute error in the spring wheat forecasts was slightly larger than for corn which has a longer forecasting period. Average absolute forecasting error also diminished with succeeding revisions for each commodity. This suggests that procedures used by USDA to collect and incorporate additional information bearing on crop size during the growing season have been moderately effective for increasing the accuracy of the crop forecasts.

USDA's first crop forecasts increased in accuracy under stable production conditions. For example, during 1929–1970 average absolute error was 4.8 percent during periods when production increased by 0 to 10.0 percent from year-earlier levels and 5.8 percent when production declined by 0 to 10.0 percent from year-earlier levels (Table 4). The 4.8 error percentage is 2.0 percentage points lower than the average error associated with production increases and the 5.8 error percentage is 2.3 percentage points lower than the average error associated with estimates made during years when production declined from year-earlier levels.

Forecasting accuracy was lower during periods when production declined than when production increased relative to the previous year. For example, when production declined by more than 20.0 percent the average error in the first forecasts was 13.4 percent or 4.3 percent higher than those which occurred when production increased by more than 20.0 percent.⁵ This phenomenon may reflect the fact

⁵ This finding is consistent with results of Clough's study [4, p. 143] which suggests that the probability of a large negative error in corn production forecasts is higher than the probability of a large positive error.

Table 3. Size of average absolute percentage forecasting error in USDA crop forecasts by commodity and forecast month, 1929-1970^a

Commodity	Absolute Error by Forecast Month								
	December _{t-1}	April	May	June	July	August	September	October	November
	(Percentages)								
Barley					7.1	3.1	2.2		
Corn					9.2	5.9	4.0	2.8	2.0
Oats					4.9	2.9	2.4		
Potatoes						5.5	4.5	3.2	2.6
Soybeans						5.6 ^b	5.1 ^c	3.7 ^c	2.9 ^c
Spring Wheat					10.7	6.7	3.0	2.8	
Winter Wheat ^d	11.5	8.5	7.6	6.9	4.0	2.1			

^a Forecasting error equals the absolute difference between the forecast and the December revised estimate expressed as a percentage of the December revised estimate.

^b Percentages computed from data for 1944-1970.

^c Percentages computed from data for 1940-1970.

^d Error percentages for December_{t-1} winter wheat forecasts computed from data for 1942-1970. Error percentages for other winter wheat forecast months computed from 1929-1970 data.

that accurate forecasting is difficult when large, unpredictable yield reductions (e.g., caused by drought, blight) occur after the first forecast is developed.

While USDA forecasts exhibit desirable characteristics when appraised by Criterion No. 2, it is possible that forecasting errors which reach levels as high as 9 to 11 percent (e.g., corn and wheat first forecasts in Table 3) may create planning problems for farmers and marketing firms. When price elasticities of demand are relatively low,⁶ as is the case for several of the commodities, an unexpected change in marketings of about 10 percent can produce large, unexpected price changes which disrupt

⁶ See [3, p. 59] for price elasticity of demand estimates for five of the commodities examined in the study.

plans of farmers and agribusiness firms. This problem may diminish in importance, however, since absolute forecasting error has decreased in recent subperiods.

Detection of systematic error

There is some tendency for USDA first forecasts to be biased toward underestimating crop size.⁷ About 55 percent of the first crop forecasts for 1929-1970 underestimated actual crop size (Table 5). Moreover, the percentage of first forecasts which underestimated crop size remained relatively constant over the period 1939-1968. The frequency of underestimation

⁷ A similar bias was found by Baker and Paarlberg [2, pp. 110-112] in an earlier study which examined the accuracy of winter wheat and spring wheat production forecasts.

Table 4. Size of absolute percentage error in USDA first crop forecasts associated with amount of change in production from year-earlier levels, seven commodity averages, 1929-1970

Change in Production from Year-Earlier Levels	Absolute Forecasting Error by Subperiod					Weighted Average 1929-1970
	1929-1938	1939-1948	1949-1958	1959-1968	1969-1970	
<i>Increase (%)</i>						
0-10.0	5.3	5.6	5.4	3.1	5.8	4.8
10.1-20.0	7.6	10.8	8.6	4.6	— ^b	7.7
over 20.0	8.8	10.2	9.4	7.3	— ^b	9.1
weighted ^a average	7.7	8.2	7.4	4.3	5.8	6.8
<i>Decrease (%)</i>						
0-10.0	4.6	7.1	7.6	3.5	3.7	5.8
10.1-20.0	7.9	6.4	8.2	5.2	9.9	7.1
over 20.0	16.9	6.4	11.6	8.4	— ^b	13.4
weighted ^a average	12.9	6.8	8.4	4.9	5.1	8.1

^a Computed by weighting percentages for each subperiod by number of observations within each change category for each subperiod.

^b None of the changes in production from year-earlier levels fell in the +10.1 to 20.0 percent, +20.0 percent, and -20.0 percent ranges during 1969-1970.

Table 5. Percentage of USDA first crop forecasts below December revised crop estimates and percentage of first crop forecasts which underestimated amount of production change from year-earlier levels, seven commodity averages, 1929-1970

Subperiod	Percentage of Forecasts Below December Revised Estimates	Percentage of Forecasts Underestimating Amount of Change					
		Increase in Production from year-earlier levels (%)			Decrease in Production from year-earlier levels (%)		
		0-10.0	10.1-20.0	over 20.0	0-10.0	10.1-20.0	over 20.0
1929-1938	36.7	42.9	62.5	40.0	80.0	66.7	72.2
1939-1948	65.2	52.6	90.9	81.8	26.7	62.5	75.0
1949-1958	54.3	64.7	63.6	60.0	52.9	66.7	60.0
1959-1968	60.0	65.0	85.7	42.9	40.0	75.0	60.0
1969-1970	64.3	20.0	— ^b	— ^b	42.9	50.0	— ^b
weighted ^a average	55.1	55.9	77.3	55.8	44.1	66.7	68.7

^a Computed by weighting percentages for each subperiod by number of observations within each subperiod.

^b None of the production changes from year-earlier levels fell in the +10.1 to 20.0 percent, +20.0 percent, and -20.0 percent ranges during 1969-1970.

was greatest for potatoes, winter wheat, and spring wheat where 59.5, 67.7, and 54.8 percent, respectively, of the first forecasts underestimated crop size during 1929-1970 (figures for individual crops are not shown in Table 5). For other crops, the percentage of USDA first forecasts which underestimated crop size averaged about 51.0 percent. However, there was substantial variability in the extent of underestimation of crop size for individual commodities over the subperiods. For 1959-1968, for example, 60 percent of the corn forecasts and 80 percent of the forecasts for both barley and oats were below the December revised estimates. During 1949-1958, 30 percent of the first forecasts for corn and oats and 70 percent of the forecasts for soybeans, potatoes, and winter wheat underestimated actual crop size.

First crop forecasts tend to underestimate the size of year-to-year changes in production, particularly the larger changes. For example, during 1959-1968, 86 percent of the first forecasts made during years in the period when production increased from year-earlier levels by 10.1 to 20.0 percent underestimated the amount of this change. Similarly, during 1959-1968, 75 percent of the forecasts for years when production decreased by 10.1 to 20.0 percent from the year before underestimated the size of the reduction. The tendency toward underestimation of amount of change was small (55.9 percent of forecasts) during periods when production increased by 10 percent or less from year-earlier levels. USDA actually overestimated the amount of the reduction during periods when crop production declined from year-earlier levels by 10

percent or less. According to Theil [6], the tendency to underestimate the amount of change is common in forecasting. In crop production forecasting it is probably caused largely by the process used in developing the forecasts whereby the first forecast is made assuming that growing conditions will be approximately normal from the time of the first forecast until harvest time.

Summary and Implications

USDA crop forecasts have become more accurate over time and exhibit desirable properties when appraised by the three criteria. Although this study revealed no serious inadequacies in the crop forecasts, the analysis identified a few persistent inaccuracies in the forecasts. Specifically, USDA tends to (1) underestimate crop size, (2) underestimate the size of changes in production from year-earlier levels, particularly when the changes are large, and (3) undercompensate for errors in previous forecasts when developing revised crop production forecasts. USDA officials and others responsible for improving the forecasts may wish to take these problems into account when methods of further improving the accuracy of the forecasts are considered. Users also might take account of these tendencies when developing expectations concerning future crop production and price levels.

Detailed suggestions are not offered for changing the present system of developing crop forecasts on the basis of the study. USDA, which is more familiar with the complex proce-

dures involved in developing the forecasts, is in a better position to decide whether it is feasible to remedy the problems identified. However, one observation may be in order. The study indicated that progress in improving the accuracy of the crop forecasts has been gradual and the results can be considered somewhat modest. It is possible that innovations such as remote sensing will permit some improvement

in forecasting accuracy.⁸ However, it appears that until environmental uncertainties can be predicted or controlled, sizable errors in USDA crop forecasts will occur occasionally and improvements in the accuracy of the forecasts probably will continue to be modest.

⁸ Ferris discusses the potential of remote sensing for improving the accuracy and timeliness of crop forecasts in [5].

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Harmonic Analysis of Seasonal Data: Some Important Properties*

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The harmonic model has important properties which enable OLS (Ordinary Least Squares) to be used to estimate efficiently a stable seasonal pattern. These properties are considered, and a procedure is suggested to facilitate a trade-off between simplicity and precision in the specification of the model. Two empirical examples illustrating this procedure are presented.

SINCE the work of Fourier in the eighteenth century, it has been known that a discrete series could be reproduced by the superposition of a finite number of sinusoidal terms, together with a correction term for the mean.

Early work in the analysis of time series in the physical sciences and in economics started with Fourier analysis and was characterized by the search for the significant sinusoidal components called the "hidden periodicities." This led to the development by Schuster [17, 18, 19] of periodogram analysis which became the principal tool used to detect hidden periodicities. The periodogram gave unbiased but inconsistent estimates of the contributions of the component waves and in time was discarded to be replaced by modern spectral analysis. Harmonic analysis, because of its close connection with the periodogram, was also virtually abandoned.

Interest has recently been revived in the use of harmonic analysis, notably by Abel [1] and Waugh and Miller [22]. The fundamental difference between the approach of these recent studies and the earlier applications is that harmonic analysis is used to estimate a cycle of known period, rather than to search for the significant cyclical components.

The harmonic model possesses some very attractive theoretical properties (due principally to Grenander and Rosenblatt [11] and Hannan [12, 13, 14]) that do not appear to have been utilized in the recent applications to the estimation of a stable seasonal pattern.¹ It is the purpose here to emphasize these prop-

erties and suggest a procedure that enables them to be used to advantage.

The Harmonic Model and Its Properties

In what follows it will be assumed that interest lies in estimating the seasonal component of the monthly series (y_t) and that any trend in the data has been removed by a suitable linear filter. This filter will affect the estimate of the seasonal component, but this estimate (from the detrended data) can always be adjusted by multiplication by a factor² derived from the frequency response function of the filter.

Hannan's model [13, p. 32] is adopted, i.e.,

$$(2.1) \quad y_t = \sum_{k=1}^6 \{ \alpha_k \cos \lambda_k t + \beta_k \sin \lambda_k t \} + u_t,$$

where³

$$(2.2) \quad \lambda_k = 2\pi k/12,$$

and (u_t) is a stationary series with

$$(2.3) \quad \xi(u_t) = 0.$$

It is also assumed that observations have been taken over m complete years, so that $t=1, 2, \dots, n$ and $n=12m$. Defining vectors y , δ , and u , and the $(n \times 11)$ matrix X as:

$$(2.4) \quad y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}, \quad \delta = \begin{bmatrix} \alpha_1 \\ \beta_1 \\ \vdots \\ \beta_6 \\ \alpha_6 \end{bmatrix}, \quad u = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix},$$

$$X = \begin{bmatrix} \cos \lambda_1 & \sin \lambda_1 & \cdots & \cos \lambda_6 \\ \cos 2\lambda_1 & \sin 2\lambda_1 & \cdots & \cos 2\lambda_6 \\ \vdots & \vdots & \ddots & \vdots \\ \cos n\lambda_1 & \sin n\lambda_1 & \cdots & \cos n\lambda_6 \end{bmatrix}$$

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¹ There is, of course, a divergent stream of the literature which treats seasonal adjustment by other methods, e.g., analysis of variance methods (Foote and Fox [9]), moving average methods such as Census Method II (Shiskin *et al.* [20]), and autoregressive schemes (Box and Jenkins [6]).

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² Hannan has tabulated this factor [13, p. 36] for several commonly used filters.

³ Only 11 coefficients are estimated since the term $\sin \lambda_6$ is always zero.

the model (2.1) can be written in the form

$$(2.5) \quad y = X\delta + u.$$

Thus, the harmonic model is a special case of the classical linear regression model and possesses two important properties which can be used to facilitate the estimation of the α_k and β_k . These properties are the asymptotic efficiency of the ordinary least squares estimators and the orthogonality of the regressor variables.

Asymptotic efficiency of OLS estimators

It has been shown by Grenander and Rosenblatt [11, p. 247] that estimation of the α_k and β_k in (2.1) by the method of ordinary least squares (OLS) produces asymptotically BLU estimators, regardless of the covariance structure of (u_i) .

In the general linear model, OLS estimators are only efficient under the restrictive condition that the u_i are serially uncorrelated. If this condition is not met, the OLS estimators may have unacceptable large variances and be therefore practically useless. Efficient estimators can be obtained by Aitken's method of generalized least squares [2], but this involves the estimation and inversion of the variance-covariance matrix of (u_i) , adding to the complexity of the procedure.

Terrell and Tuckwell [21] provide justification for the use of asymptotic properties in this context. Most economic time series exhibit evolving seasonal patterns, and the stable (harmonic) model may only be appropriate over relatively short periods. Terrell and Tuckwell generated models with known autocovariance structures and examined the small sample properties of the OLS estimator. They showed that provided a suitable filter is used to remove the trend, OLS is usually⁴ very efficient (even for series as short as three years) and that the variances of these estimates differ only slightly from both the BLU estimator and the asymptotic approximation. The principal advantage, then, of harmonic analysis, compared with other methods of obtaining the seasonal component, is its extreme simplicity. It can be performed with any standard regression package and should be very efficient even for fairly short economic series.

⁴ Terrell and Tuckwell [21] examine the conditions under which OLS estimates are likely to be inefficient.

Orthogonality of the regressor variables

Regression is undertaken to obtain the simplest linear model which will adequately describe the phenomenon being investigated. It is necessary then to achieve a balance between including too many variables (and so unnecessarily complicating the model) and omitting relevant explanatory variables (which will lead to misspecification bias in the estimators and often serial correlation in the residuals).

Usually, one problem which must be faced is that owing to the correlation between the estimates: the addition or removal of regressor variables necessitates reestimation. Returning to the model (2.4), (2.5) it can easily be verified that if

$$X = [X_1, X_2, \dots, X_{11}],$$

then

$$(2.6) \quad X_i'X_j = 0, \quad (i \neq j).$$

This property of the regressors is called orthogonality. It is well known [10, p. 200] that whenever (2.6) holds, the estimates of the coefficients are uncorrelated, and the addition or removal of explanatory variables will have no effect on the estimates of other regression coefficients.

In several recent applications of harmonic analysis [1, 7, 22] it appears that attempts have been made to fit seasonal data using only one or, at most, two harmonics. It seems that this approach is probably based on two considerations.

First, it may have been tacitly assumed that higher harmonics are of less significance than lower harmonics. The first harmonic would normally be expected to explain more of the seasonal variation than any other component [12, p. 6; 13, p. 34], but other than this, there seems to be no justification in the underlying Fourier theory for such an assumption. It is quite possible, for example, that the wave with $k=5$ may be more significant than that for which $k=2$.

Second, in the search for the simplest model which adequately fits the data, it may have been decided to omit harmonics which, *a priori*, were suspected to be of marginal significance. The presence of orthogonality makes such an approach false economy. For instance, Waugh and Miller [22] found significant serial correlation in their residuals in a number of re-

gressions and consequently had difficulty in interpreting the t statistics. A more systematic approach would be to include all six harmonics initially and then to remove those which do not contribute sufficiently⁵ to the explanatory power of the model. Owing to orthogonality, there would be no alteration to the estimates of the remaining harmonics.

It is worth noting at this point that the particularly simple expressions for $\hat{\alpha}_k$ and $\hat{\beta}_k$ given by Hannan [13] can easily be shown to be the OLS estimators.

A Suggested Procedure for Estimating the Seasonal Component

In most regression work the significance of the estimates is measured by either a t test or an F test. Both these methods depend on the assumption that the residuals (u_t) are normal and serially uncorrelated. When the time series (y_t) has no trend, this assumption would usually be quite realistic. However, it was assumed in this paper that any trend has been removed by an appropriate linear filter. It is important to realize that even if the residuals were originally uncorrelated, the application of a linear filter results in the introduction of a covariance structure in the residuals [8, pp. 50, 51].

As the OLS estimator is asymptotically efficient, regardless of whether or not (u_t) is serially uncorrelated, dependence on the t and F tests to determine significance clearly negates any advantage obtainable from this property. It would be desirable to have a criterion for the acceptance of an explanatory variable which does not depend on the covariance structure of (u_t).

A procedure is suggested for the selection of harmonic terms in the model which are based on the proportion of the explained variance due to each variable.

It is well known [15, p. 22] that

$$\frac{1}{n} \sum_{t=1}^n \hat{y}_t^2 = \sum_{k=1}^{11} \hat{\delta}_k^2$$

where

$$\hat{y}_t = \sum_{k=1}^6 \{ \hat{\alpha}_k \cos \lambda_k t + \hat{\beta}_k \sin \lambda_k t \}$$

⁵ What constitutes "sufficiently" will be a judgment by the researcher depending on how he trades off precision and simplicity.

and $\hat{\delta}_k$ is the estimate of δ_k , the k th component of δ defined in (2.4).

Thus, the total explained variance can be expressed as the sum of the variance of each harmonic term. This is a direct result of the orthogonality property.

Define

$$(3.1) \quad V_k = \hat{\delta}_k^2 / \sum_{i=1}^{11} \hat{\delta}_i^2,$$

then V_k gives a measure of the contribution of the corresponding harmonic term to the total explained variance of the model. Taken in conjunction with R^2 , one has a measure of the explanatory power of the complete model and the proportion of the explained variance that will be lost for each variable which is excluded. Where there has been no trend removal, \bar{V}_k is directly proportional to ΔR_k^2 , the increment to total R^2 due to the k th term. However, when a trend has been removed, it is the adjusted estimates which ultimately are of interest, and ΔR_k^2 will not give a measure of the proportion of the variance that the adjusted coefficients contribute. For example, most trend removal filters will also remove most of the fundamental harmonic (see Table 2) and ΔR^2 would measure the contribution of this reduced fundamental, which would be misleading.

Using this result, a suggested procedure is to estimate the complete model (2.6) by OLS and then omit those variables which contribute little to the total explanation of the model. This will be indicated by the value V_k . This approach is more rational than arbitrarily discarding some terms before estimation and avoids the risks of having serially correlated errors unnecessarily and of leaving out terms which could significantly improve the fit of the model.

A Test of Significance

The above procedure is advanced as a possible approach in situations where serial correlation in the residuals renders tests of significance based on t or F invalid and where the investigator does not want to launch into spectral analysis. However, based on the spectral density function, an asymptotic test of significance can easily be derived. Once again, the results of Terrell and Tuckwell [21] enable one to test with considerable confidence in a practical situation.

It has been shown by Moran [16] that the OLS estimator is asymptotically normal with

mean δ . Also, Grenander and Rosenblatt [11, p. 246] show that the variance-covariance matrix of $\hat{\delta}$ is asymptotically

$$\text{diag}(c_1, c_1, c_2, c_2, \dots, c_6, c_5, c_6)$$

where

$$(4.1) \quad c_k = \begin{cases} \frac{4\pi}{n} f(\lambda_k), & k \neq 6 \\ \frac{2\pi}{n} f(\lambda_k), & k = 6 \end{cases}$$

and $f(\lambda)$ is the spectral density function of (u_t) . If a consistent estimator $\hat{f}(\lambda)$ is used [8, p. 96] instead of the unknown $f(\lambda)$, then

$$\frac{\hat{\alpha}_k - \alpha_k}{\sqrt{\hat{c}_k}}, \quad \frac{\hat{\beta}_k - \beta_k}{\sqrt{\hat{c}_k}}$$

will be approximately standardized normal variables.

Thus, in testing the significance of estimates of coefficients, the relevant Z ratios (standard normal deviates) are approximately

$$(4.2) \quad \hat{\alpha}_k / \sqrt{\hat{c}_k}, \quad \hat{\beta}_k / \sqrt{\hat{c}_k}.$$

Empirical Analysis

The analyses of two time series are presented to demonstrate the properties of the harmonic model. The choice of the series is based on their didactic advantages. The first series contained no trend (Fig. 1) and, as expected, was not complicated by serial correlation in the residuals. The second series (Fig. 2) required

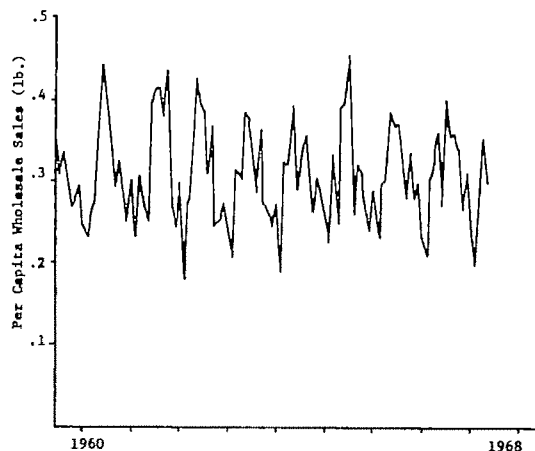


Figure 1. Monthly wholesale sales of table rice per capita, Australia

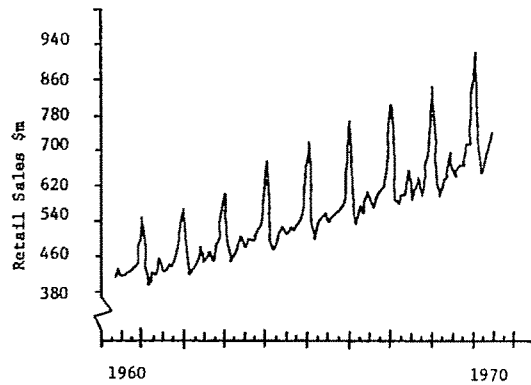


Figure 2. Monthly retail sales, Australia

filtering and involved the procedure suggested in the earlier parts of the paper.

The first series consisted of monthly wholesale sales (lb.) per capita of Australian table rice for the nine-year period of May 1959 to April 1968. The data were adjusted to account for variation in trading days. Population data used to convert sales to a per head basis were derived by linear interpolation into quarterly population estimates [3, p. 5; 4].

Ordinary least squares regression was used to estimate the seasonal parameters of (2.1) after adjusting for the mean. The results are presented in Table 1. Because the calculated Durbin-Watson statistic (D.W.) indicated the absence of serial correlation, the t test was valid as a test of significance of the coefficients. Accordingly, the terms for which $k=1, 2, 3, 7$, and 11 are significantly different from zero at the 5 percent level and an acceptable model would contain these five terms. The seasonal coefficients which emerge are not those which

Table 1. Seasonal component of monthly sales of table rice, Australia

k	$\hat{\delta}_k$	t_k	V_k^a
1	.0331*	6.288	.2654
2	.0494*	9.390	.5909
3	.0134*	2.555	.0434
4	.0055	1.054	.0073
5	.0015	0.292	.0005
6	-.0026	-0.493	.0016
7	-.0147*	-2.804	.0523
8	.0018	0.345	.0008
9	.0078	1.479	.0147
10	.0078	1.484	.0147
11	.0097*	2.609	.0228
		D.W.=2.00	R ² =0.62

* V_k is the proportion of explained variance as defined by (3.1).

Table 2. Seasonal component of monthly retail sales, Australia

k	δ'_k	H_k	δ_k	Z_k	V_k
1	.00384	5.236	.02008	23.302	.1312
2	.00282	5.236	.01477	17.146	.0710
3	-.00045	1.104	-.00050	1.261	.0001
4	.02795	1.104	.03086	78.375	.3098
5	-.02593	1.000	-.02593	29.859	.2188
6	.00184	1.000	.00184	2.117	.0011
7	-.01067	0.987	-.01053	4.653	.0361
8	-.01203	0.987	-.01187	5.244	.0458
9	.01689	0.997	.01684	13.314	.0923
10	-.01609	0.997	-.01604	12.678	.0837
11	.00559	1.000	.00559	10.135	.0102
D.W.=3.06					
$R^2=0.96$					

would easily be chosen by inspection of the data alone.

However, of these five terms the contributions to V suggest using only the fundamental harmonic—the terms for which $k=1$ and 2. That is,

$$\hat{y}_t = .0331 \cos \lambda_1 t + .0494 \sin \lambda_1 t$$

$$(R^2 = 0.62; V = 0.86),$$

where V is the sum of the V_k for the terms included in the model.

For this particular series a model was recommended which could possibly have resulted from an arbitrary choice, but it is comforting to have a measure of the proportion of explained variance lost by omitting the other statistically significant terms.

The second time series analyzed was monthly Australian retail sales (excluding motor vehicles) [5] for the period of April 1961 to May 1970. Figure 2 shows that the series displays distinctive multiplicative characteristics as well as a trend.

A slight modification of Spencer's 15-point filter was applied to the logarithms of the raw data so that the assumptions of the harmonic model (2.1) were appropriate. The filtering process resulted in the loss of 14 observations. Thus, the following model was assumed⁶:

$$y'_t = \sum_{k=1}^6 \{ \alpha'_k \cos \lambda_k t + \beta'_k \sin \lambda_k t \} + u'_t$$

⁶ In what follows we use primes when dealing with detrended data. The trend-corrected estimates have no primes.

$$\left(\lambda_k = \frac{2\pi k}{12}; t = 1, 2, \dots, 96 \right).$$

The results of the estimation of α'_k and β'_k by OLS regression are found in Table 2.

The value of the Durbin-Watson statistic indicates the presence of serial correlation in the residuals, as expected in a series which has had a trend removed by a linear filter. The Z ratios, defined by (4.2), were calculated using a spectral estimate based on a lag window width of 40.

If the regression had not removed the total seasonal contribution (as would often be the case—particularly if the seasonal pattern was evolving), the spectrum of the residuals would have contained spikes at the seasonal frequencies λ_k ($k=1, 2, \dots, 6$). This would usually mean [15] that the Z ratio would have an upward bias inversely proportional to the lag window width. However, the calculations of Z , with varying window widths, were quite stable.

A comparison of the t and Z ratios showed considerable differences; and for the coefficient δ'_6 , the t ratio indicated lack of significance at the 5 percent level, while the Z ratio showed it to be significant.

The Z ratios showed all coefficients except δ'_6 to be significant at the 5 percent level. From these significant coefficients, multiplied by the factor H_k ,⁷ the following model was selected on the basis of the values of V_k (the proportion of the explained variance due to δ_k):

$$\hat{y}_t = .0201 \cos \lambda_1 t + .0308 \sin \lambda_2 t - .0259 \cos \lambda_3 t$$

$$(R^2 = 0.96; V = 0.66)$$

If the terms with coefficients δ_2 , δ_9 , and δ_{10} were also included, V would be increased to 0.91.

It is stressed that the two models suggested above are only intended as illustrations of how the V_k may be used to measure the cost (in terms of explanatory power) of obtaining greater simplicity. Just as the context determines the level of significance chosen in testing the coefficients (in terms of the cost of making a Type I error), so the context will determine if or how V_k is used to achieve greater simplicity.

This procedure seems to be less arbitrary than the common practice of omitting terms prior to estimation.

⁷ $H_k = [1 - h(\lambda_k)]^{-1}$, where $h(\lambda_k)$ is the factor tabulated in [13].

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A Note on Uncertainty and Nonmarket Cost*

DUANE CHAPMAN

A generalization of the Friedman-Savage hypothesis of utility maximization under risk proves that in the presence of a convex nonmarket cost function and a joint probability density function of future output and nonmarket cost, expected nonmarket cost can exceed the nonmarket cost of anticipated output.

GROWING concern with environmental quality has been associated with increasing interest in welfare theory. The theory of utility maximization with uncertainty offers a modest contribution to this growing literature by indicating a logical basis for supposing that uncertainty about output levels and nonmarket cost will increase expected nonmarket cost. Succinctly stated, expected nonmarket cost will exceed the nonmarket cost of planned output if nonmarket cost is a convex function of output and if a joint density function exists for output and nonmarket cost.

The original utility maximization analysis by Friedman and Savage [1] employed two discrete alternatives. Using their analysis, assume that nonmarket cost is the component of social cost which is not included in the market cost of a commodity, that P is the probability of a particular output X_1 occurring, and that $(1-P)$ is the probability of the alternative output level X_2 . Using $E[\]$ to represent expected value and $N(X)$ to represent nonmarket cost as a function of X , expected output is $E[X] = P \cdot X_1 + (1-P) \cdot X_2$ and expected nonmarket cost is $E[N(X)] = P \cdot N(X_1) + (1-P) \cdot N(X_2)$. As Figure 1 indicates,¹ expected nonmarket cost exceeds the nonmarket cost of the expected output whenever uncertainty exists such that $0 < P < 1$.

The assumptions in this case are restrictive. Uncertainty attaches to output while nonmarket cost is assumed to be clearly known. It is more common for output to be planned (albeit with some uncertainty) and for nonmarket cost to be unknown. In addition, only two alternatives are permitted, and expected

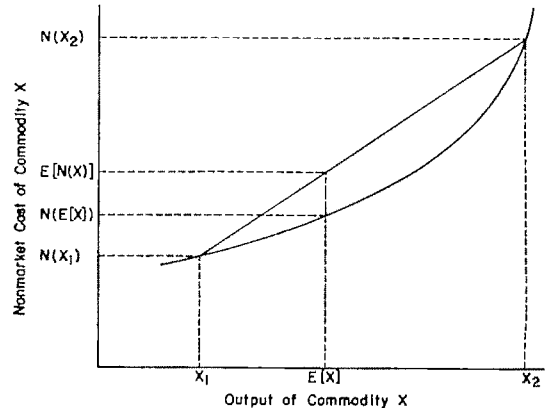


Figure 1. Nonmarket cost and output, limited case

output— $E[X]$ —may not be one of these permitted alternatives.

A solution to these problems is suggested by the nature of nonmarket cost. Consider a planned increase in output of commodity X which is intended to increase output to X_0 , and let X be a continuous variable which will be above or below (but near) X_0 . The environmental significance and its associated nonmarket cost N can be considered to be a random variable. First, consider the primary physical by-products of (a) mineral and fuel extraction and transportation, (b) processing of factors, and (c) air, water, and land pollutants emitted in the production of X . They cannot be known with certainty. Second, the relationships of these physical by-products to human health and natural ecosystems are generally not well understood at present. Third, the valuation of damages (the nonmarket cost) is most complicated and cannot be known with certainty. Finally, assume that both output and nonmarket cost are numerical valued variables within defined ranges. In summary, define $f(X, N)$ as the joint probability density function of future output and nonmarket cost.

It can now be shown that wherever nonmarket cost is a convex² function of output and

* Helpful comments and suggestions were received from T. Mount, V. R. R. Uppuluri, and reviewers of the *Journal*.

¹ A numerical example: nonmarket cost is $N(X) = X^2$ for X between 50 and 100, the probability of output being 50 is .3, and the probability of output being 100 is .7. Expected nonmarket cost is $E[N(X)] = .3(50)^2 + .7(100)^2 = 7750$. Nonmarket cost of expected output is $(.3 \times 50 + .7 \times 100)^2 = 7225$.

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² Convex is used here in its strict sense and should be read as excluding linear functions.

uncertainty exists in the form of a joint probability density function, expected nonmarket cost exceeds the nonmarket cost of planned output.

A general definition of convexity is

$$(1) \quad K(X_0)(X - X_0) < N(X) - N(X_0)$$

where $K(X_0)$ is the slope of the tangent to $N(X)$ at X_0 . (See Figure 2 which illustrates this definition; equation (1) holds whether $X \geq X_0$.) Multiply both sides of equation (1) by $f(X, N)dXdN$ and through integration

$$(2) \quad \begin{aligned} & K(X_0) \iint (X - X_0) f(X, N) dXdN \\ & < \iint N(X) f(X, N) dXdN \\ & \quad - \iint N(X_0) f(X, N) dXdN. \end{aligned}$$

If X_0 is made the expected value of X , then the term on the left under the integral represents the expected differences between X and expected X : $E[X - X_0] = \iint (X - X_0) f(X, N) \cdot dXdN$. Since $X_0 = E[X]$, there is no expected difference and $E[X - X_0] = 0$. The first term on the right represents expected nonmarket cost, $E[N(X)]$. The second term on the right represents expected nonmarket cost at the expected output level, and this is simply $N(E[X]) = N(X_0) = N(X_0) \iint f(X, N) dXdN$ since $\iint f(X, N) dXdN = 1$. Therefore,

$$(3) \quad N(E[X]) < E[N(X)]$$

and expected nonmarket cost is greater than the nonmarket cost of expected output.

In the unlikely case of complete certainty where $j(X_0, N_0) = 1$, the inequality disappears. Two speculative interpretations are offered.

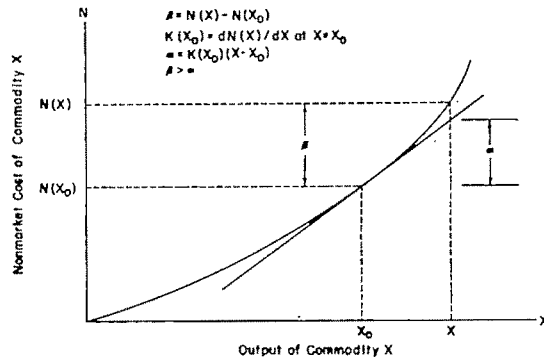


Figure 2. Convex nonmarket cost

First, in the improbable case that the firm's expertise implies certainty and conservationist nonexpertise implies uncertainty, then nonmarket costs as seen by experts ($j(X_0, N_0) = 1$ and $E[N(X)] = N(E[X])$) will be less than nonmarket costs as seen by conservationists. One might generalize by speculating that expertise implies more certainty implying less expected nonmarket cost.

Alternatively, it might be concluded from the likely existence of uncertainty about nonmarket costs and actual future output levels that conservationists have a firm theoretical basis for believing expected nonmarket cost to exceed the nonmarket cost of expected output.

It is the writer's opinion that convexity is the general characteristic of the nonmarket cost function of most commodities for present and future production levels. If so, the result is generally applicable. If attention focuses on anticipated nonmarket cost, uncertainty and convexity, where present, compound nonmarket cost and suggest the desirability of a more cautious attitude towards growth in all such industries with significant nonmarket cost.

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Economies of Size and the Spatial Distribution of Land in Farming Units*

WARREN E. JOHNSTON

Economies of size studies may erroneously point to excessive machinery capacities on large-scale farming units. This paper shows a simple but illustrative example of the influence of the spatial distribution of land on machinery requirements for increasing sizes of farms in the Imperial Valley of California.

TRADITIONAL economies of size studies appear to disregard the fact that many of today's large farming units operate on acreages not immediately adjacent to, or contiguous with, the farm's operational headquarters. Farm operators, under pressure to enlarge farm size, are aware of economies of adding near-at-hand tracts of land, as evidenced by their willingness to pay more for such tracts than for similar but more distant parcels.¹ This note suggests that the excess machinery capacities which might be inferred from economies of size investigations may be illusory in part, and that the spatial distribution of tracts of land farmed influences power equipment capacities and economic efficiencies of farming units.

Consider the traditional economies of size study for crop-producing farms generally concerned with technical economies of machinery use over ranges of farm size. A common approach is to synthesize typical machinery combinations, using survey information for several representative sizes of farming units in the study area. Whether the investigator then uses a budgeting or a parametric programming approach (depending on whether fixed or variable enterprise combinations are assumed), he usually establishes fixed power equipment requirements per crop acre and equipment availabilities expressed in total hours per time

period as technical coefficients and capacity restraints, respectively. The investigation then proceeds with an analysis of increasing sizes of operation as though all the acreage required over ranges of increased sizes were in ready access and proximate to the headquarters (center of operation) of the synthesized farming units. An implied assumption appears to be that there are no significant diseconomies associated with the physical operation of enlarged farming units on tracts spatially distant from headquarters.

In the data-gathering phase of a study of cash-crop farming units in the Imperial Valley of California [1], each farm operator in the sample was asked to locate on a map his headquarters and each tract of owned or rented land. Summarization of the survey data revealed that the dispersion of farmed land was more widespread with increasing farm size (Table 1). Furthermore, individual parcels were not generally located in the same direction from farm headquarters—that is, parcels were scattered. The representative typical acre² farmed was 2.2 miles from headquarters for Size III farms, 4.0 miles for Size IV farms, and 4.4 miles for Size V farms. Thus, it became apparent that one should consider the changing spatial distribution of farming units as they increase in size and also examine the influence that typical spatial dispersions might have in analyses of increasing farm sizes.

This consideration led to the comparison of results of analyses based on two different specifications of equipment availabilities, i.e., restraints about total hours available for field use per time period. The first, termed "perfect" availability, was determined by power requirements and performance rates for each crop common to the study area. The second specification, "adjusted" availability, incorporated

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¹ In a recent study of farm real estate transfers [2] purchasers were asked, "In relation to going prices in the area for comparable land at the time of purchase, do you think the price you paid for the property was high, about average, or low?" Location and proximity to other tracts owned by the purchaser were frequent explanations for "high" prices and one explanation given for a "low-priced" transaction was that the parcel "... was isolated from the rest of the owner's operation."

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² "Typical acre farmed" was determined by weighting the percentage of land farmed in each zone by distance zone midpoints (miles) from farm headquarters.

Table 1. Three large farm size groups and average distribution of land farmed, Imperial Valley cash-crop farms, 1966

[illegible]

* Zones are concentric circles about the farm headquarters. Zone 1 includes all acreage within one mile of headquarters; Zone 2, all acreage within one to three miles, etc.

adjustments designed to take into account the complexity of farming operations on dispersed acreages. A delay factor of one day per change of operation per farmed block of land was assumed appropriate to reflect losses in availability because of setup, repair, maintenance, and transport time for power equipment (wheel tractors, crawler tractors, and cotton pickers) and their implements.³ Using survey information about the approximate size of contiguous blocks of land farmed in each zone, a block of land was defined as 320 acres or less in Zone 1 and a parcel of 160 acres or less in all other zones. Thus, hours available per time period, using adjusted availabilities, is always less than that for perfect availabilities⁴; and consequently the capacity of farm operations (determined by machinery availability restraints) is effectively reduced.

³ Unfortunately, the identification of the problem discussed in this article was not apparent until examination of the farming operation maps. The assumption made here resulted from the questioning of selected farm operators and other knowledgeable persons about the possible magnitude of delays in farming operations. Had the emergence of this problem been foreseen, it would have been preferable to have included appropriate questions in the original survey. The subsequent inquiry upon which the assumption is based was, however, made prior to selection of both coefficients and restraints for models used in the analysis.

⁴ For adjustment details, see [1, pp. 55–57].

For purposes of empirical comparison, it is probably most useful to consider the results for Size III and IV farms, since the largest, Size V farms, represents an open-ended size group described subjectively as farms of 2,500 acres and more. Assuming *perfect* machinery availabilities and a common fixed rotation,⁵ physical capacities determined by equipment availability restraints for typical Size III and IV farms were estimated to be 1,817 and 3,153 acres, respectively (Table 2). These capacities were larger than the largest farm surveyed in either group (1,536 and 2,450 acres, respectively). A hasty inference might be that excess machinery capacity is characteristic of the farms.⁵

If, however, one takes into account the reduction in machinery availabilities due to farming spatially-dispersed tracts of land by incor-

⁶ Alfalfa, 30 percent; milo (grain sorghum) and sugar beets, 15 percent each; barley, cotton, and milo-barley doublecrop, 10 percent each; and lettuce and lettuce-milo doublecrop, 5 percent each.

⁶ One might question whether some excess capacity might be rationalized as a reserve contingency to meet unseasonable or unusual weather delays. Although this is perhaps reasonable in some farming areas, the merit of the study area is that weather in the arid Imperial Valley is more predictable than it might be in other areas—it is usually hot and dry! (Normal total annual precipitation is 2.30 inches/year and the range of normal mean temperatures is from 53.9° (Jan.) to 92.9° (July).)

Table 2. Capacity of farm operations with perfect and adjusted machinery availabilities and fixed rotations, Imperial Valley cash-crop farms

Capacity comparisons	Physical Capacity of Farm Size Group		
	Size III 1000-1749 acres	Size IV 1750-2499 acres	Size V 2500, and more, acres
Perfect machinery availability	1,817 acres	3,153 acres	4,068 acres
Adjusted machinery availability	1,518 acres	2,551 acres	3,178 acres
Difference in capacities	299 acres	602 acres	890 acres
Ratio of capacities*	120 percent	124 percent	128 percent

* Ratio of capacities (acreages)—“perfect” ÷ “adjusted”—an indication of the effect of disregarding the spatial distribution of farmed land.

porating *adjusted* machinery availability restraints in the analysis, physical capacities are reduced by 299 and 602 acres for typical Size III and IV farms, respectively (again, see Table 2). Indicative evidence of excess machinery capacities is thus diminished, and resultant capacities more nearly approximate the sizes of farm operating units observed in the study area. Physical capacities under the assumption of perfect availabilities are 20 percent or more higher than those attempting to acknowledge effects of farming dispersed parcels of land.

Although the assumption of fixed rotations is perhaps a questionable abstraction from reality, its use does demonstrate that inference about excessive machinery capacity in studies of large-scale farming units may be somewhat questionable. (Similar empirical results also were attained in analyses using variable enterprise combinations.) In particular, diseconomies resulting from the dispersed location of farmed land may warrant explicit consideration as studies of large-size farm units are continued.

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A Practical Way to Select an Optimum Farm Plan under Risk*

JOHN T. SCOTT, JR. AND CHESTER B. BAKER

This paper uses quadratic programming to calculate the variance-efficient mean income path and associated lower income bounds and suggests a way to select an optimum farm plan under risk based on the farmer's own self-assessed income-risk preference function. An empirical example from a Midwest corn-soybean farm is presented.

MUCH has been written about risk in farming, including the major causes of risk such as plant and animal diseases, variations in the weather and other environmental changes, price fluctuations, variations in human ability and judgment, etc. [10, 15]. It has been hypothesized that the degree of risk is affected by the magnitude of the variances and the relationship of the covariances of income of different enterprises in combination with each other [10, 11]. The expected income-variance ($E-V$) efficient frontier was developed as a theoretical approach to portfolio selection [13, 14]. Subsequently, it was shown that this efficient-variance expected income set could be reduced for the decision maker by comparing the standard error confidence limits of the expected incomes from the various portfolio combinations [3]. Only recently have empirical attempts been made to quantify the riskiness of various income possibilities and to find an optimum with regard to the income-risk portion of an entrepreneur's utility function [1, 2, 4, 7, 12, 16, 18].

The quadratic programming (QP)-risk aversion model is theoretically appealing because it incorporates the income variances and covariances of the possible enterprise combinations [5, 8] and can be used to describe the ($E-V$) efficient frontier [17]. Also, the quadratic programming model contains a "risk aversion coefficient." But no one has been able to quantify a correspondence between the risk aversion coefficient and a decision maker's utility function. So, this model has thus far had little empirical use. Other similar models have been developed mainly to reduce computa-

tion cost [6, 9], but these also lack empirical content.

The linear programming, focus-loss constraint model developed by Boussard and Petit [4] offers a somewhat different basis for describing the farmer's perception of risk in context of a resource allocation model. Its conceptual weakness lies in its failure to account for the covariance relationship.

Development of the foregoing models has been a proper and necessary antecedent task. But neither their development nor their empirical results have thus far had much practical effect in farm management, mainly because no way has been developed to determine the value of a risk aversion coefficient for an individual farmer or for identifiable problems.

The Method and Empirical Results

This paper shows how to integrate the theory extended by Baumol [3] and the quadratic programming model to calculate meaningful alternatives. It avoids the practice of relating the risk aversion coefficient to a person.

The results can be displayed graphically to the decision-making farmer in a simple and easily understood way. The farmer is left to choose the enterprise combination and level of production on the basis of his own preference—his own introspective risk aversion.

The quadratic programming-risk aversion model is given in matrix notation by

$$\text{Maximize } Z = U'X - dX'WX,$$

$$\text{Subject to } AX \leq B,$$

where U is a vector of mean incomes for the activities, X is the vector of activities, d is a scalar called the risk aversion coefficient, W is the variance-covariance matrix of the activity incomes, A is the matrix of input-output coefficients for the activities, and B is the vector of resource restrictions.

When d is zero, the solution gives the combination producing the maximum mean income

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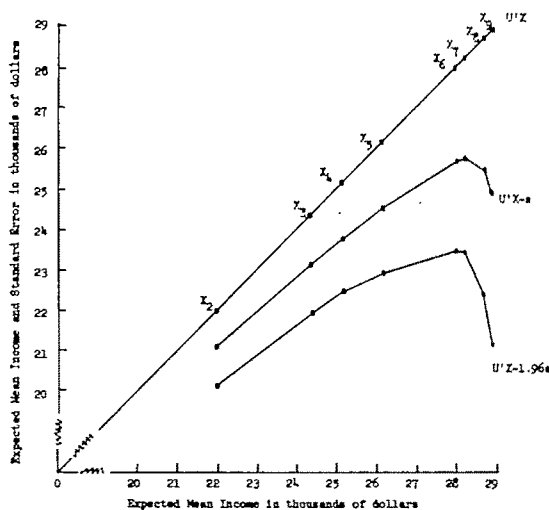


Figure 1. Expected mean income and standard error paths for example farm

possible with the given restriction set and is the same as the linear programming solution.

When d is large, only a small income is produced, low levels of activities are activated, and most resources are idle. Parameterizing d in the computer program will give the $(E-V)$ efficient frontier. While this will result in the same outcome over the relevant range of the $(E-V)$ frontier as the procedure suggested by Stovall [17], the procedure used here has direct correspondence with the QP -risk aversion model and is computationally easier with existing programs.

The example used to illustrate the foregoing method is a typical central Illinois cash grain farm of 400 acres. The alternate production activities include corn, soybeans, oats, wheat, and idle land to be used for conservation purposes or to meet the requirements in the 1972 government feed-grain program. They are typical for Corn Belt farmers.

Data requirements of the QP model, employed to derive the variance-efficient income map (illustrated in Figure 1), include the average or expected net returns for each activity, input-output coefficients, the variance-covariance matrix of net returns for each activity, plus resource restrictions and government program restrictions.

Annual observations on prices and yields over the past 10 years were used to estimate mean expected returns. These same observations were used to calculate elements of the variance-covariance matrix.

Corn grown under the government program

and eligible for price-support loans is a special case. The government price-support figure was used whenever it was above the market price; but when the market price exceeded the government support price by five cents per bushel or more, the market price minus five cents per bushel was used. This five-cent difference is approximately what it costs a farmer in interest charges and other fees to remove corn from the government price-support loan and sell it on the open market. These costs are not incurred when the market price falls below the government support price and the farmer allows government takeover of the corn in lieu of loan repayment. This method of estimating returns for corn under the government program actually results in a slightly lower average return, as well as a substantially lower variance than for corn raised outside the government feed-grain program.

The assumptions made about items in the government program are that this 400-acre farm has a 200-acre corn base and also a government-designated 90-bushel yield for purposes of calculating payments on set-aside and diverted acreage. This results in 50 acres being required for set-aside, to be paid at the rate of \$72 per acre, and up to an additional 40 acres of optional diverted land at \$46.80 per acre under government plan one, with no other limitation on planted acres. Under government plan two, 50 acres would be set aside at \$72 per acre, with up to an additional 40 acres of optional diverted land also at \$72 an acre. But, in plan two the total corn acreage would have to be reduced below the amount of corn planted last year by two acres for each acre diverted above the required set-aside number, with no other limitation on planted acreage. It was also assumed that last year's planted corn was equal to the base (200 acres). The net income from set-aside and diverted acres is reduced by the cost of seeding and maintaining this conserving acreage. But, of course, the income for these activities has no variance in a planning sense, since it is known beforehand and guaranteed by the government. All of these alternatives and restrictions are incorporated into the quadratic program.

Based only on average net return above variable costs per acre with no consideration for variance, the production activities rank from high to low as follows:

1. corn outside the government program
2. corn in the government program

Table 1. Example farm production combinations both with and without government programs for the variance-efficient mean income path

	Open mkt. corn	Sealed corn	Soybeans	Wheat	Oats	Set- aside	Plan 2 diversion	Idle land	Mean income $U'X$	Standard error $[X'WX]^{1/2}$	$\Delta U'X$ $\Delta[X'WX]^{1/2}$	$U'X-s$	$U'X-1.96s$
	Acres										Dollars		
X_0								400	\$ 5,775*	\$ 0		\$ 5,775	\$ 5,775
X_1						50	40	310	21,977	963	16.82	21,014	20,090
X_2		69.9	85.2	92.6	62.3	50	40		24,368	1,243	8.54	23,125	21,932
X_3		120.0	97.2	77.0	15.8	50	40		25,110	1,382	5.34	23,728	22,401
X_4		120.0	116.6	73.4		50	40		26,156	1,668	3.66	24,488	22,887
X_5		120.0	144.4	45.6		50	40		28,053	2,370	2.70	25,683	23,408
X_6		164.8	167.6			50	17.6		28,193	2,442	1.94	25,751	23,407
X_7		200.0	150.0			50			28,678	3,217	.63	25,461	22,373
X_8	210.8								28,888	3,967	.28	24,921	21,113
X_9	400.0		189.2										

* Returns above variable costs.

3. soybeans
4. set-aside acres
5. diverted acres under plan two
6. diverted acres under plan one
7. wheat
8. oats.

The numerical results of production, both with and without the government feed-grain program, for the ($E-V$) efficient frontier are given in Table 1. Only X_8 and X_9 are without government programs. Each X value is a basis change in activities obtained with parametric changes of the QP -risk aversion coefficient. Along with each combination are given the mean income produced by that combination, the standard error of that income, and the ratio of the increase in mean income to the increase in the standard error.

The proportional increase in the standard error from the lowest to the highest income is always equal to or greater than the increase in income. In fact, it is always greater in these examples. This is shown by the ratio of the increase in income to the increase in standard error, which gets smaller as income rises. In Table 1, for example, the first income increase is more than 16 times the accompanying one in the standard error, while the last increment in income is less than a third of the associated increment in the standard error. Also given in the table are the values $U'X-s$ and $U'X-1.96s$ which are the 1 and 1.96 standard error values below each mean income.

Following Baumol's theoretic extension, the values in Table 1 are used to plot the graph in Figure 1. The X_i points on the $U'X$ line are the various successive enterprise combinations producing greater income. If income is approximately normally distributed, then about 84 percent of the time income from the different respective enterprise combinations would be

greater than the 1 standard error lower income bound and about 97.5 percent of the time income would fall above the 1.96 standard error lower income bound.

Also following Baumol's suggested criteria for decision making, a farmer with no aversion to risk or a high gambling spirit would select combination X_0 (all corn) which produces the highest mean income, even though it also has the highest variance. A farmer with moderate aversion to risk would likely select combination X_7 which has three-fourths as many acres of soybeans as corn and has the minimum amount of "set-aside" required to be in the government program, because this combination is at the peak of the 1 standard error lower income bound. A farmer with a high aversion to risk would likely pick X_8 which has about equal amounts of corn and soybeans along with the required "set-aside" and a small amount of diversion at the higher payment rate, because this combination gives the maximum outcome on the 95 percent lower income bound. However, income at the maximum point of the 95 percent lower income bound (X_8) is only one dollar higher than the income of combination X_7 on the same lower income bound. So, essentially, the farm operator could be indifferent between X_8 and X_7 or let his decision be ruled by other criteria outside the programming model.

If properly explained in an extension-type publication or by a consultant, any commercial farmer who has the resources and business acumen to be operating at a scale that would involve computer-assisted farm planning would certainly be able to understand this approach to risk assessment in farm planning. Such a farmer would also be able to combine enterprises on the basis of this variance-efficient mean income map, which will account for his

own degree of aversion to or desire for risk. A farmer may decide that the small increase in expected income (for example, from X_7 to X_8 or from X_8 to X_9) may not be worth the associated increase in risk and required farm organi-

zational change. He can make such decisions for himself after studying a graph showing his alternative expected income possibilities along with their standard error lower income bounds as in Figure 1.

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Assembly and Distribution System Management: An Application of Lockset*

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The "lockset" routing technique can be used to answer policy questions concerning assembly or distribution systems as well as to design routes for assembly or distribution systems. The procedure was illustrated utilizing a problem in wholesale food distribution. Routing systems were developed for seven different cases, each designed to evaluate a specific policy question.

MANY firms and institutions are confronted with the complex task of designing expensive multistop routing systems for the distribution or assembly of people or commodities from or to a single physical plant. Firms in nearly every industry must design a system to service customers with a given fleet of vehicles and a pool of drivers or servicemen. School districts must formulate routes to pick up and deliver school children. The local postal service must design routes for the delivery of mail.

The work of Dantzig and Ramser [4], and more recently Clarke and Wright [3], represents a major contribution to the development of techniques to design such systems. The basic procedure has been described by Schruben and Clifton [10] (who termed it the "lockset" method) and others [5, 6] and has been applied to a wide variety of problems.¹ Hallberg and Kriebel [6] modified the procedure to incorporate several special constraints, including constraints on the road network over which the vehicles can travel,² and designed a computer

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¹ Such applications include developing efficient routes for retail milk distribution [5], wholesale food distribution [6], and farm feed distribution [10], scheduling milk tank trucks among dairy farms for milk assembly [7], and estimating costs of alternative methods of intracity delivery of eggs [11]. (The latter was suggested to me by one of the *Journal* referees.)

² It should be noted that the approach of these authors in generating a solution to the problem is heuristic since no well-defined algorithmic procedure is generally feasible (see [6]). That is, a systematic search is undertaken for the best solution based on a set of rules specified *a priori*. Thus, the approach does not guarantee that an optimal routing system will be found. Nevertheless, experience suggests

program for its implementation.³

Thus, given the information⁴ describing the distribution or assembly job to be done, an operational technique to generate an efficient routing system for accomplishing the task is now available. While it is always possible to generate a routing system without the aid of this technique, generally it is quite difficult and most often results in a system not even near optimal.

But the lockset method is not limited to designing efficient routing systems for an existing distribution or assembly job—it can also be utilized by management for generating answers to specific policy questions concerning the assembly or distribution system. Such questions might include: What sized trucks should be used? Should drivers be allowed to work overtime? Should that prospective new customer be served? What charges should be assessed for delivery or assembly?

The purpose of this paper is to illustrate, by utilizing a problem in wholesale food distribution, how some of these questions can be answered with the lockset method. Although the specific results cannot be generalized, this paper will illustrate how such results could be used by management for planning purposes or for generating answers to specific policy questions.

Analysis of the Distribution System for a Wholesale Food Distributor

The firm involved in this study was a wholesale food distributor serving primarily institu-

that this procedure generally out-performs any feasible and known alternative—including the human dispatcher.

³ This program is available from the author. IBM [8] and other private consulting firms apparently have similar programs; however, at the present time, they are not generally available to other researchers or to the general public.

⁴ That is, the location of the distribution center, the location of customers to be served, the conditions under which they are to be served, the number, type, and capacity of vehicles available, the road network over which they can travel, and the number of drivers or servicemen available.

Table 1. Characteristics of delivery systems developed for typical day's deliveries for sample food distribution under assumed conditions, 41 customers to be served, and 39,053 pounds of merchandise to be delivered

Case	Constraints		Characteristics of Delivery System				Added Cost of Meeting Customer Delivery Times			Cost Reduction when Drivers Allowed to Work Overtime		
	Maximum Delivery Duration	Time Restrictions	Number of Routes	Total Miles Driven	Total Time Required ^a	Total Cost ^b	Miles	Hours	Cost	Miles	Hours	Cost
	Hours				Hours	\$			\$			\$
A	8 1/2	no	4	248.0	25.1	294.57	—	—	—	—	—	—
B	8 1/2	yes	5	325.1	30.3	339.35	77.1	5.2	44.78	—	—	—
C	12 1/2	no	3	246.4	25.1	291.68	—	—	—	1.6	0	2.89
D	12 1/2	yes	4	296.7	29.1	324.80	50.3	4.0	33.12	28.4	1.2	14.55

^a Includes a 30-minute lunch break for each route in excess of 3 1/2 hours.

^b Driver cost was estimated at \$8.25 per hour of non-lunch time on 8 1/2 hour or less routes. On routes requiring more than 8 1/2 hours, drivers were assumed to be paid at the time and one-half rate for overtime. Truck costs were estimated on the basis of discussions with truck leasing companies in Pennsylvania and include a fixed daily rental fee plus a per-mile cost.

tions in a large metropolitan area. Merchandise delivered by this firm included items such as napkins and paper plates, frozen foods, canned foods, and fresh meats.

Customers of this firm place their orders for delivery on a fairly regular basis (that is, on a certain day or days of the week), but the content of the orders can vary substantially from one order placement to another. Furthermore, the customers can place an "emergency" order any time during the week. A distinguishing feature of the problem is that the firm wishes to set up its delivery system so that each customer receives his order during a prespecified time interval—for example, customer A will not accept his order prior to 8 a.m. or later than 11 a.m. A "typical" day's operation for this firm involves delivering a total of 39,053 pounds of merchandise to 41 customers.⁵ The firm leases delivery vehicles and has at its disposal a fleet ranging in size from a 2,000-pound capacity panel truck to a 30,000-pound capacity tractor-trailer rig.

Solutions to several variations of this routing problem were obtained by the lockset technique. Each variation was designed to provide information to aid management in decision making concerning their routing system. The relevant information from these solutions is shown in Tables 1 and 2. The route costs shown

⁵ The amount to be delivered to each customer was measured in pounds. This is not a very satisfactory procedure since one pound of napkins requires more truck space than does one pound of fresh meat. A better approach would have been to measure the amount to be delivered in both weight and volume (e.g., cubic feet of truck space required) and to consider both when determining which vehicle is to serve each customer (weight and volume can be considered simultaneously in the program referred to in footnote 3). Unfortunately, volume data were unavailable for this problem.

in these tables include a driver cost for only those hours required to complete the route. The assumption here is that the driver can be productively employed elsewhere in the business if his route requires less than 8 1/2 hours to complete.

Effect of permitting drivers to work overtime

One question that a firm involved in product delivery must face is whether it should permit its drivers to work overtime. Before this question can be investigated, the feasibility of such a change must be examined in light of all the constraints on the delivery system: Is sufficient vehicle capacity available? Are drivers available who would work overtime? Are customers receptive to the idea of either late or early deliveries?

For the sample food distributor, routes were developed on two assumptions: that vehicles could be on the route no more than 8 1/2 hours and that vehicles could be on the route no more than 12 1/2 hours. The relevant comparisons are Case A versus Case C and Case B versus Case D.

When all other constraints were met, the estimated cost for the delivery system whose vehicles were allowed on the route 12 1/2 hours (Case D) was \$14.55 lower than that of the delivery system whose vehicles were allowed on the route only 8 1/2 hours (Case B). Similarly, a comparison of Cases A and C indicated that permitting drivers to work overtime reduced estimated delivery cost by \$2.89.

These cost reductions were due primarily to the fact that in each instance at least one vehicle was eliminated. Thus, the cost savings achieved through more efficient fleet utilization and route design outweighed the added expense of overtime pay.

Table 2. Characteristics of distribution systems developed for sample food distribution under the assumption that one new customer requiring 4,000 pounds of merchandise is added and comparisons with Case B solution

Case ^a	Distance New Customer is Located from Plant	Delivery Time Restriction for New Customer	Characteristics of Delivery System				Added Cost Relative to Case B		
			Number of Routes	Total Miles Driven	Total Time Required ^b	Total Cost ^c	Miles	Hours	Cost
	miles				hours	\$			\$
E	25	2 pm-4 pm	5	341.5	32.2	356.97	16.4	1.9	17.62
F	50	2 pm-4 pm	6	404.3	35.2	400.27	79.2	4.9	60.92
G	50	5 am-5 pm	5	384.0	34.5	374.68	58.9	4.2	35.33

^a For each case routes were developed so that all restrictions on customer delivery time were met and all routes were completed within 8½ hours.

^b Includes a 30-minute lunch break for each route in excess of 3½ hours.

^c Driver cost was estimated at \$8.25 per hour of non-lunch time on 8½ hour or less routes. On routes requiring more than 8½ hours, drivers were assumed to be paid at the time and one-half rate for overtime. Truck costs were estimated on the basis of discussions with truck leasing companies in Pennsylvania and include a fixed daily rental fee plus a per-mile cost.

Effect of changing restrictions on customer delivery time

In the problem outlined above, the firm attempted to deliver each customer's order within a specified period of time during the day.⁶ This was intended, in part, to be an added service to customers and was a matter of negotiation between firm and customer. Thus, the firm may well be able to change these restrictions, at least for some customers, if it would be beneficial to do so, i.e., if it would lower distribution costs.

This question was also examined with the results shown in Table 1. The relevant comparisons are Case A versus Case B and Case C versus Case D. By ignoring all restrictions on customer delivery time, estimated delivery expense was reduced by \$44.78 in the former comparison and by \$33.12 in the latter comparison, approximately the cost of renting and operating two medium-sized delivery vehicles one day exclusive of driver cost.

It is interesting to note that the solution for Case A failed to satisfy delivery-time restrictions for only 8 of the 41 customers. Armed with this additional information, the firm could contact these eight customers to see if their delivery times might be changed accordingly.

As another comparison, consider Cases F and G in Table 2. The latter illustrates how much an unsatisfactory delivery time restriction for just one customer can cost the firm—in this instance \$25.59 for one delivery day.

⁶ Because of unforeseen developments, these restrictions were not always met on all delivery routes as actually run by the firm.

Effect of adding one new customer

Most business firms are interested in expanding volume, and one way to accomplish this is to add new customers. While it is not always true, it is generally true that a firm will seek to add only those customers who bring in more revenue than expenses. The expenses involved include selling, warehousing, and delivery. Selling and warehousing expenses are relatively easy to determine, but expenses associated with delivering a new customer's order, however, are quite another matter. The cost of serving a new customer will depend in part on how far the customer is located from the distribution center but, more importantly, on how a new customer fits into the existing delivery system: Is he located near existing customers so that he can be served on an existing route? Is his volume such that an additional delivery vehicle will be required? Can his delivery be made during existing delivery hours?

In Case E (Table 2) a new customer requiring 4,000 pounds of merchandise, located near the distribution center (at 25 miles), on an existing delivery route, and to be served between 2 p.m. and 4 p.m. was assumed. Compared to Case B (the comparable case prior to the addition of the new customer), the same number and type of vehicles were required. But under the conditions of Case E the new customer increased delivery expense by \$17.62 or 44.1 cents per 100 units of additional merchandise delivered. This is contrasted to 86.9 cents per 100 units of merchandise delivered in Case B.

When the new customer was located twice as far from the distribution center and was not on

an existing delivery route (Case F), the delivery expense was increased by \$60.92 over that of Case B, or \$1.52 per 100 units of additional product delivered. The relatively large increase in delivery expense for Case F over that of Case B was, of course, due to the fact that the new customer could not be served on an existing route. This, in turn, was due to the rather restrictive delivery time specified for the new customer, as indicated by the solution for Case G.

Implications

When the lockset technique is used to simulate the impact of different conditions imposed on the distribution system, it can be a very important tool to management.⁷ By comparing the costs of the distribution systems, it is clear what decisions should be made with respect to permitting drivers to work overtime, asking customers to change their delivery times, and maintaining the fleet of trucks to employ. Clearly, the new customer should be added if this would add more to revenue than to cost. This can be easily determined if management charges all customers the same rate for delivery service.

If, on the other hand, management does not charge all customers the same rate, an entirely different question needs to be resolved: What will it cost to serve this additional customer? This question can, of course, be answered as illustrated in the previous section. The next question is: Should the additional customer be charged the exact amount of the added cost? In the case where the new customer was located 50 miles from the distribution center, the answer is probably yes because the average per unit cost was increased. In the case where the new customer was located at 25 miles from the distribution center, however, the firm may wish to readjust the service charge to all previous customers since the average per unit cost was reduced. Thus, the new customer would be

charged more than the amount by which total distribution costs were increased.

To determine an appropriate service charge for different customers is neither easy nor free from elements of arbitrariness because of the many factors that must be considered. Volume to be delivered is certainly one factor and location of the customer relative to the plant is another. What is likely to be of more importance, however, is the location of the customer relative to other customers, special conditions that must be met in order to serve the customer (i.e., special vehicle requirement, time restrictions within which the delivery must be made, or particular difficulties encountered in unloading at the customer's site), and the volume required by the customer relative to the volume required by all other customers and relative to vehicle capacity.

In general, for pricing its delivery services management will need the type of guideline provided by a delivery cost function. While such a function is not easy to generate, one approach would be to formulate a number of different cases as was done in the previous section and to use the routing technique to generate solutions and estimate total delivery expense for each case. One could then use multiple regression to estimate a cost function using as many independent variables as are relevant. Different problems would necessitate a different set of variables, but in all cases the independent variables used would reflect the factors alluded to above.⁸

The technique utilized in this paper has potential as an analytical tool for management. It does have some limitations⁹; nevertheless, it has been shown to be generally superior to alternative methods. In addition, the technique can be used to answer policy questions which could be answered only partially, if at all prior to the existence of the technique.

⁷ Indeed, for some firms or institutions relocation of the physical plant may be a relevant problem. An approximate solution to this type of problem can be obtained by the generalized Weber Algorithm as outlined by Revelle *et al.* [9] and Bowersox [2]. The approximation is likely to be quite poor when used in areas where there are many natural barriers to the flow of vehicle traffic (such as Pennsylvania). Generally, however, there will be a finite number of feasible locations so that one merely needs to evaluate and compare the cost of the distribution or assembly system for each of the various plant locations. Thus, this problem can also be evaluated using lockset.

⁸ Vertrees [11] used the lockset technique to estimate costs of alternative distribution systems but did not develop cost functions as suggested here.

⁹ First, of course, this is not an optimizing technique. Thus, at least on large problems, we have no way of evaluating how "good" the solution generated is. Furthermore, the technique is not capable of handling more than one distribution center or assembly point. This is particularly crucial in the case, for example, of the school busing problem (e.g., Angel *et al.* [1]). We are presently trying to develop some capability along these lines in two different applications. Finally, the technique is designed to minimize travel time or distance rather than *total* distribution costs.

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Agricultural Marketing Research For Less-Developed Areas*

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Marketing problems are viewed in relation to developmental objectives and conditions found in less-developed countries. Underdeveloped infrastructures, intersectorial relations, and developmental objectives may make transferability of developed country concepts and formulations to LDC's questionable. Market performance criteria should be logically related to strategic developmental variables.

AFTER a surge of interest in technological change and the economics of production in less-developed countries (LDC's), agricultural markets have reemerged as major policy concerns. This discussion relates to this neglected and relatively underdeveloped subject matter area. But the focus is conceptual, concentrating on *how* marketing problems can be efficiently delineated and researched in the unique situation of a given country.

Agricultural marketing problems are viewed as derivatives of the broader problem of economic development. It is implied that the approach is instrumentalistic or pragmatic, i.e., that concern is not with what an "ideal" marketing system should be like or, more broadly, with whether there is a commitment to a particular form of social and economic organization. Ideologies are considered irrelevant except when they may impinge upon the range of politically available policy alternatives. Identification of developmentally limitational marketing factors and the invention and testing of alternative institutional means for their removal are the main issues.

It is argued that effective marketing research for development requires recognition of the following major points:

1. In an economic development context interactions among sectors become primary rather than secondary concerns;

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2. These interactions make diagnosis of what is and what is not a marketing problem both essential and frequently difficult;
3. The market structure-conduct-performance framework is applicable but only if relevant developmentally related performance characteristics are defined and applied rigorously; and
4. The terminal test of marketing research is found in whether it provides a basis for devising more effective and workable institutions for development.

Interactions Among Sectors

Norris Pritchard [6, pp. 84-85] has formally recognized the important interdependencies between growth in agricultural productivity and performance and growth in productivity in the factor and commodity marketing sectors of LDC's. Clearly, it is equally plausible *a priori* to assume that marketing problems arise from and are internally restricted in their productivity effects to the marketing sector, that they are created by exogenously induced growth in productivity in agriculture (green revolution technology), that they arise because market performance is limitational to increases in agricultural productivity or a combination of exogenously induced growth and limits to growth in productivity. The latter three of the four possibilities involve interactions between sectors, and these three are more likely to be important in the LDC's than DC's (developed countries).

In a typical developed country interactions between the marketing and agricultural production sectors, as related to productivity and technological changes within agriculture, are not as frequently important or pronounced. Studies can usually be confined without hazard to narrowly defined specialty fields because DC's have mature infrastructures which take care of most interactions and linkages between

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marketing and production.¹ For example, introduction of a new high-yielding wheat of inferior milling quality will not spoil established markets for present superior wheats, the reason being that functional grades are dependably enforced as a basis for trading on organized exchanges. Then, prices among grades register the differences in demand for products of different quality. Thus, the production problem can be isolated from the marketing problem, and the problem becomes one of upgrading the wheat's milling quality while retaining its high-yield characteristics. The innovation is not likely to create either a serious tenure or income maldistribution problem since labor markets are highly developed.

To illustrate the contrasting LDC situation, Thailand, which has an erratic record of export quality control in various products, declined to introduce officially IR-8 rice, partly for fear of spoiling the demand for the generally high quality nonglutinous product upon which the country depended very heavily for foreign exchange. The anticipated market malfunctions cancelled out the potential gain in farm productivity. Moreover, when the green revolution technology is introduced, it likely will aggravate the already serious regional income disparities.

In Thailand kenaf markets function very poorly in one critical respect—they provide almost no incentive for farmers to produce high quality kenaf for which there is a relatively large premium in international markets [9, pp. 6-8]. Yet a foreign technical assistance kenaf "expert" indicated that the problem of the kenaf industry was that the farmers just did not understand grading and did not have access to the capital required to build suitable retting facilities. The real problem, however, was located not only in the marketing sector but also in the export grade inspection services at a point remote from the farm level where the average price differentials among grades at the farm level were reduced to less than one-fourth of international market price differentials. With a highly imperfect market information system and relatively unstable average prices for kenaf, it is extremely doubtful that most farmers could distinguish any real price differentials among grades [9, especially pp. 4-6].

¹ Some American markets may be important exceptions. The problems created by technological change in food marketing seem to have exceeded the capacity of our developed infrastructure to facilitate needed organizational changes and on-farm production adjustment.

Undeveloped marketing institutions interacted with production incentives and overseas demand to stifle technological progress and dilute incentives for productive savings and investments.

Studies of Thailand fertilizer markets indicate that in the aggregate they operate quite efficiently, although the stereotype of the exploitative merchant is applied to fertilizer sellers. Imperfections exist but the principal explanations of high costs to farmers include high private credit costs (30+ percent per annum), distant overseas supply sources, and external diseconomies associated with small volume of sales in areas where fertilizer demand has not been adequately developed. The fertilizer demand problem has been complicated by low farm paddy prices caused by a rice export duty and recent low international prices, plus the late development of fertilizer-responsive varieties. In this case, what initially seemed to be a factor market efficiency problem was actually one of undeveloped credit and product markets, a consumer-oriented price policy, and retarded technological development in rice production. All resulted in undeveloped fertilizer demand at the farm level. Each element of the problem interacted with fertilizer marketing because of external economies of scale and structural deficiencies associated with low market volume [10].

Applicable Conceptual Tools

In the foregoing examples conventional neo-classical concepts which have broad applicability were used. However, other special concepts have been developed in and for research in LDC's. These include linkages and externalities,² Raup's accretionary capital formation relating to nonmonetized capital formation in peasant agriculture [7], and Wharton's subsistence level categories relating wealth, aspirations, and risk aversion to innovation [12]. For marketing studies, Brewster's characterizations of traditional social structures provide important insights into the social bases of inefficient credit and input markets and obstacles to the use of the usual remedial devices [1]. John R. Commons' concepts, although developed for

² The external economies of scale concept was developed in the DC's as a conceptual basis for infant industry protectionism. Most recent refinements and applications of externalities concepts are recognized to have existed primarily in the DC's in connection with environmental control and natural resource development problems. However, their origins are traceable to other concerns.

other purposes, are related to the early historical development of Anglo-American economic institutions and provide important bases for understanding marketing and production problems in less-developed countries with less-developed polities [2]. For example, in Thailand there are laws against fraud. But these laws mean little in the animal feed business because there is no institutional machinery to assure the purity of the feedstuffs sold. Peasants cannot afford to take feed dealers to court when adulterated feed kills a chicken or a pig, even if the courts administer the law fairly. The effective capital assets of the farmer are discernably diminished as a result of such "institutional deficiencies," deficiencies to which Commons' concepts of property are relevant.

This is only a partial list of specialized concepts which appear applicable as supplementary tools in the "developmental diagnostic processes" and which are made essential by the interdependencies and interactions among sectors in LDC's and their unique social and political structures. It is meant to suggest that the peculiarities of problem configurations in LDC's make these special concepts applicable, and that invention of additional special concepts, such as the new Hayami-Ruttan meta production function [4, pp. 82-83], may be necessary to provide the missing "glue" to give power and relevancy to marketing research. The Hayami-Ruttan explanation of differences in the patterns of technological change may provide a clue to what is needed in marketing research in LDC's. It suggests the possibility that direct transfers of marketing research "technologies" developed in and for the DC's should be viewed no less skeptically than are transfers of agricultural production technology from one environment to another.

If new concepts are needed which could be adapted to the problems of LDC's, then the comparative method of early Cornell fame, Commons' plea for examination of similarities and differences [2], and Salter's case study method [8, pp. 71-72] may have renewed applicability as *concept-generating devices*. Surely, careful analytical comparisons of situations in two areas with different patterns of experience in the particular industry or commodity (while rarely providing definitive tests) can often be highly suggestive of the interconnection of events not embraced by received theory. The comparative analysis by Hayami and Ruttan

[4, especially pp. 111-164] led to an important one.

Transferability of the structure-conduct-performance framework

Given the development orientation, markets are studied to improve performance of some kind. Thus, the structure-conduct-performance framework seems applicable. But adaptations may be required to specify developmentally relevant performance criteria and to develop effective means for testing hypotheses about connections between manipulatable structural and organizational characteristics of markets and these performance characteristics, and for appraising the feasibility and effectiveness of means to elicit desired performances.

While a "modified market structure-conduct-performance framework can be useful..." [3, p. 7], only a few of Sosnick's 25 effective competition criteria [11] are applicable in a developmental context. Priorities change from pure requisites of survival at early stages of development to the "niceties" which DC's regard as "essentials." Moreover, LDC's confront problems which were "worked out" by tradesmen, farmers, bureaucrats, politicians, and researchers of DC's long ago. But even among LDC's conditions and priorities differ. Distribution of wealth and power is by no means as important in the smallholder agriculture of Southeast Asia as it is in Latin America.

American marketing systems of an earlier time were less highly developed; trained manpower supplies were short; legally sanctioned grades and standards were not yet in common use; and market information systems, rules of trading, and the like were still to be worked out. In this situation concern was deferred over such things as "undesirable externalities" and "maldistributed risk." Now that incomes are high and the essentials of a functioning marketing system have been established, Ralph Nader can mobilize an army of people worried about such things as environmental pollution, isolated instances of food contamination, and misleading advertising claims. By contrast, in the LDC's a little uncertainty about quality in consumer goods and a few deaths from parathion poisoning seem to be the necessary costs of increasing productivity and income. Increased income makes it possible to mount assaults on more pervasive problems such as malaria, malnutrition, and tuberculosis.

Given the high priority which must be attached to income and productivity objectives, the perfect market concept—plus some of the “special concepts” noted heretofore—has some obvious utility as analytical framework [5]. Concern is with fashioning crude but workable tools, not with honing them to a fine edge. But even if the high priority of the productivity and income objective is assumed, the performance criteria implicit in the perfect market concept are nevertheless oversimplified, if viewed in developmental policy perspectives. Markets and market institutions often have diffuse and important effects on strategic developmental variables. These developmental variables include technological progress, saving and investment, foreign exchange acquisition, political power balances conducive to progressiveness in institutional reform for development, and political stability (to the extent that this impinges on capabilities for future governmental effectiveness).³

Performance criteria are logical derivatives of the strategic developmental variables, although varying in relative importance from situation to situation.⁴ They include:

1. *Progressiveness within the marketing sector:* This includes creation and rapid diffusion of adapted technology and managerial or organizational innovations resulting in increased productivity and reduced costs. One example is the competitive pressures for introduction of the more efficient rubber dehuller roller for rice.

2. *Provision of opportunities for technical efficiency in marketing and farming:* This means access to new technology-embodied inputs produced either locally or abroad, absence of protectionistic restrictions on use of more efficient inputs, provision of suitable inspection services (so that more efficient methods can be employed without danger to consumers), and

³ Maldistribution of income and unemployment are recognized as legitimate concerns. But their developmental significance is partly related to political stability and political power balances conducive to progressiveness in institutional reform for development.

⁴ The conventional distinctions among structure, conduct, and performance employed by students of industrial organization are not employed here in their usual meanings. By analogy to intermediate products which become income inputs to subsequent production processes, some of the “performances” which we identify are important precisely because they establish the decision-making environment (structure) or motivate behavior (conduct) which influences other conduct and performances strategic to development.

timely, reliable delivery of production inputs; for example, state rather than municipal meat inspection so that chilled carcasses, rather than bulky, live animals, can be transported from distant producing areas.

3. *Favorable price-cost relations and minimization of marketing margins:* This involves the avoidance of taxes and duties or noncompetitive structures which reduce incentives for cost reductions, elimination of excess profits, elimination of excess capacity, or avoidance of non-minimum cost scale. Efficient state or cooperative distribution of fertilizer as a competitive leadership element is an example.

4. *Minimization of price and market risks to producers and marketing firms:* This could be implemented by the avoidance of structural situations in which “whipsawing” and other price-destabilizing competitive tactics produce unnecessary risks to producers or competing firms, especially those which are financially vulnerable, and provision of assured market outlets at “reasonable” prices. For example, the government could sponsor standby support programs or organized provincial markets with market news broadcasts so that villagers would no longer have to accept single offers from itinerant buyers for their product to avoid the risk of having no other offers.

5. *Reliability of export product quality and effective articulation of relative demand for different qualities of product (price signals) to producers and processors:* This would include development of functional export grades and rigorous enforcement of such grades in international transactions by appropriate export quality control and inspection services, effective transmission of price differentials among grades through marketing channels to serve as incentives for rigorous assorting according to grade and other quality control procedures, and for investments in quality-improving capital items. A good example is needed reform in export quality control for kenaf in Thailand, which was referred to above [9].

6. *Minimization of opportunities for corruption of government officials:* In addition to the nonworkability of programs in which officials are easily corrupted, such programs may defeat attempts to develop bureaucratic ethics and public confidence upon which efficient general development program administration depends. This criterion obviously pertains primarily to

programs providing infrastructure and remedial actions for markets which malperform otherwise.

7. *Reliability of farm inputs and intermediate products in marketing channels:* This will depend on the avoidance of adulteration, fraudulent claims, and mislabelling of farm inputs to minimize risk in their use by farmers. Rules of trading might be instituted to penalize or effectively prevent misapplication of grades, adulteration of products, and sale of contaminated products which would lower demand for the product. For example, regulatory machinery is urgently needed in Thailand to stop the prevalent adulteration of protein feedstuffs for poultry and swine by nonprotein nitrogen and fillers.

Feasibility Testing of Alternative Means for Solving Marketing Problems

It is useful to know that the reason for market malperformance is, say, monopsonistic competition. However, this information is of practical significance only if there are identifiable alternatives which are politically and

legally tolerable, budgetarily fundable, culturally and psychologically acceptable, and which are better than the present situation when judged against relevant performance criteria. It is fairly easy to generate "solutions" if the realities of limited trained manpower, scarce public finance, existing local cultural and religious norms, and corrupt, unresponsive bureaucracies can be "assumed away." It is relatively difficult to invent and test workable alternatives when these limitations are taken into account.

Conventional neoclassical economic concepts have great utility in the testing of proposed alternatives. However, the "name of the game" is the invention of more functional institutional patterns. This requires someone to address directly the question of what makes an institution function well or poorly in a particular cultural, political, economic, and historical context, i.e., in a less-developed country with a limited capital and a weak institutional infrastructure.

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Consumer Attitudes and Their Impact on Fluid Milk Demand in Hawaii: A Component-Regression Analysis Approach*

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Demand analysis for various fluid milk products at the retail level was extended beyond the usual price-quantity-income relationships. Use of component factor analysis has introduced attitudinal and taste information useful for market development, merchandising activities, and regulatory policy promulgation.

DEMAND analysis and the indifference curve approach have emphasized price-quantity relationships primarily with income and other tangible socioeconomic variables as demand shifters. This approach overlooks the ordinal consumer attitudes relating to taste, acceptability, and personal preferences and their impact on consumer behavior in the market. This approach on the part of practicing economists stems mainly from circumventing the admitted difficulties in quantifying these phenomena (to estimate their impact on demand functions especially) for a closely related group of products. To the extent that products are substitutes for one another by their intrinsic physical or chemical characteristics but separated by way of product differentiation, market research has fallen short of explaining consumer behavior in the applied demand analysis.

Introduction of state regulation and control of milk production and prices coincided with the appearance of filled milk on the market in the State of Hawaii. Within six months after its introduction in September 1967, filled milk sales captured 21 percent of the local fluid milk sales in the Oahu milk shed and this share has been maintained since then.

This paper reports on the use of component factor analysis to analyze consumer attitudes towards three important fluid milk products in the Honolulu metropolitan area: regular whole milk, skim milk, and filled milk. The influence of attitudinal factors and socioeconomic vari-

ables on the consumption of these products is estimated.¹

Fresh milk is defined as cows' milk that has been processed by pasteurization or standardization containing not less than 3.25 percent butterfat. *Skim milk* is fresh milk from which a sufficient portion of butterfat has been removed to reduce its butterfat content to less than 3.0 percent. *Filled milk* is any milk or skim milk, whether fresh or recombined, to which any fat or oil other than butterfat has been added or blended so that the resulting product is in semblance of fresh milk.

Empirical Analysis

Data collection and analysis

A random sample of 250 households in the Honolulu metropolitan area was chosen from the Oahu Telephone Directory. A questionnaire was designed to collect the socioeconomic data, consumption data for regular milk, skim milk, and filled milk, and the respondents' attitudes towards these three products using 20 experimental differential variables. The data were collected by personal interview during a two-month period between March 15 and May 13, 1970. An adult member of the family was chosen randomly from the sample household and interviewed. Among those interviewed, 62 percent were housewives, 13 percent husbands, and 11.5 percent were other adult members of the family. Non-family households accounted for another 12 percent of the sample. Thus, while all adult ages and sexes were included in the attitudinal sample, the attitudes of housewives received a greater weight and it is assumed that this pattern prevails even in household buying habits.²

¹ Behavioral scientists have used factor analysis and Osgood [3] introduced the semantic differential technique as a tool for measuring the intangible but subtle differences in meanings of concepts.

² A recent survey of supermarket buying habits in Hawaii indicated that the housewife does the shopping alone

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The socioeconomic variables in the questionnaire included number, age, and sex of members in the household, family income after taxes, amount spent on food at home per week, education, employment status, and, finally, ethnic origin of the head of the household. Milk consumption statistics included quantity consumed and amount spent on the three milk categories in the week preceding the survey.

Consumer attitudes for regular milk, skim milk, and filled milk were collected on a seven-point experimental scale for 20 attitudinal tests grouped under acceptability, taste, nutritional, health, economic, and societal images of the products for the purpose of designing the questionnaire. Tests and average scores of the sample for the three milk products under study are given in Appendix Table 1. The actual attitudinal dimensions extracted for the products by component factor analysis differ according to the product characteristics and consumer attitudes [4].

Socioeconomic characteristics of the sample

The average number of members in the household in the sample was 3.7 and the total average annual income of the households was in the \$9,000-\$10,000 bracket. Nearly 42 percent of the housewives surveyed were gainfully employed. Twenty-five percent of the housewives surveyed were Caucasians, while 35.6 percent were Japanese, 9.3 percent were Chinese, and the rest were reported as mixed or other ethnic groups. The average household expenditure on food consumed at home was between \$30 to \$39.9 per week.

A total of 235 households responded to the questionnaire and 214 among them reported consuming at least one of the fluid milk products under study during the week prior to the interview.

The factor analysis was performed by the MESA I computer program using the principal axes method for unrotated factors and varimax rotation of the original factors [1]. Oblique rotation using the biquartimin rotation

of the varimax factor loadings was done using Carroll's oblimin computer program.³

Labelling

The component analysis resolved the consumer attitudes data into different dimensions depending on the clustering pattern of attitudinal test scores for each of the products (Table 1). The dimensions are interpreted and labelled to describe the factors. For labelling the factors, test scores that have a very high loading (over .75) were given emphasis over test scores with moderately high loadings (between .5 to .75).⁴

Consumer attitudes for *regular milk*, as determined by the survey, fell into six dimensions. These factors are labelled: (1) acceptability factor, (2) nutritional factor, (3) health factor, (4) price factor, (5) economic factor, and (6) societal factor.

Attitudinal variables for *skim milk* have resolved into four non-trivial factors: (1) acceptability factor, (2) societal factor, (3) personal appearance factor, and (4) price factor.

Consumer attitudes toward *filled milk* fell into three dimensions labelled as: (1) acceptability factor, (2) evaluative factor, and (3) societal factor.

The attitudinal dimensions as labelled for the three products have the acceptability factor in common, though the relative emphasis of test scores within the dimension varied for the three products as seen from their factor loadings. Thus, regular milk acceptability (F_{1r}) emphasized taste and liking by children, while

³ These computer programs were revised for IBM 360/65 and were generously made available by the Dimensionality of Nations research group, University of Hawaii, for which the authors express their thanks. Rotated factor solutions using the varimax rotation (MESA I Computer Program) and the oblique factors (using Carroll's oblimin computer program) have been compared with Thurston's simple structure criteria. The test scores having significant loadings on the factors are almost the same in both solutions, while biquartimin solutions came closer to the simple structure criteria. The primary pattern loadings of the variables on the oblique factors are given in Table 1.

⁴ It is said that the perspective the researcher has on his factor results colors their interpretation. This is more true in the case of labelling the factors and, admittedly, the labelling adapted here is not unique. However, the purpose of labelling factors in this paper is to describe the factor according to the ED variables that have highest loading on it and thus reflect a common underlying influence of it on the consumption behavior of the sample. To the extent the factors extracted have such interpretation, labelling serves the purpose of identifying them with attitudinal dimensions in the analysis.

46.1 percent of the time and another 30 percent of the time accompanied by either a child or husband [7, p. 35]. Our survey has revealed that 86 percent of the sample households bought fluid milk from supermarkets, and since the housewife does the shopping three-fourths of the time, the attitudes of the housewife are assumed to reflect the attitudes of the household decisions.

Table 1. Biquartimin rotation with identity matrix as transformation matrix*

Description of Variable	Regular milk				Filled Milk				Skim Milk			
	Accept-ability	Nutritional	Health	Price	Economic	Societal	Accept-ability	Evaluative	Societal	Accept-ability	Societal	Personal Appearance
1 Never heard/knows product very well	F_{11} 0.1679	F_{12} 0.0432	F_{13} -0.1664	F_{14} 0.1390	F_{15} -0.1349	F_{16} (0.5337)	F_{17} 0.3644	F_{18} 0.5043	F_{19} -0.0877	F_{20} 0.2863	F_{21} (0.5485)	F_{22} -0.0548
2 Not full of vitamins	0.2535	0.3859	-0.0579	0.1819	-0.2955	-0.0965	0.3231	(0.5362)	0.1549	0.4330	0.4543	-0.2262
3 Not liked by children	(0.7015)	-0.1523	-0.1697	-0.1894	0.0573	0.0297	(0.6762)	0.2098	0.0252	(0.5742)	-0.0604	0.3444
4 Tastes bad/good	(0.7862)	-0.0894	0.0104	0.0337	-0.0411	0.0033	(0.6866)	0.2518	0.0226	(0.8530)	-0.0483	-0.0321
5 High/high in calories	-0.1661	0.2458	-0.0993	(0.5905)	-0.0326	-0.8570	-0.0220	(0.8888)	-0.1441	0.0365	-0.0872	0.1820
6 High/low priced	0.9061	0.1279	-0.1420	(0.5297)	-0.1824	-0.0279	-0.2430	(0.8820)	0.2429	-0.0652	0.0080	0.1654
7 Not very nutritious	0.4148	(0.5466)	-0.2664	0.1284	0.0069	-0.0854	0.4232	(0.5366)	0.0857	0.4604	0.4611	-0.1694
8 Not liked by adults	(0.5371)	0.1727	0.1821	0.1224	0.2239	-0.0041	(0.8256)	0.1336	0.0282	(0.7574)	0.0334	-0.0570
9 Low/high in protein	-0.0165	(0.7592)	-0.0163	0.2229	0.1282	-0.0643	0.3536	(0.6023)	0.0850	0.3246	(0.5574)	0.1262
10 Watery/rich	0.1348	0.2934	-0.1421	-0.1812	0.2509	0.4828	(0.3764)	0.4676	-0.0848	0.4320	0.1989	-0.1118
11 Plain/creamy drink	-0.1627	-0.1288	0.1552	-0.1003	-0.0055	(0.8271)	-0.2219	0.4188	0.0270	-0.0690	0.4186	-0.0631
12 Poor/good value for money	0.0165	(0.5225)	0.2524	-0.2993	-0.4268	0.0619	0.2219	(0.6125)	0.2063	0.1992	0.4261	-0.0951
13 For the people/weight matters	-0.1453	-0.1280	(0.6312)	-0.0292	-0.1360	-0.0143	0.0193	0.1087	(0.8465)	0.0215	(0.7296)	0.1221
14 Diluted/liked by entire family	(0.6295)	0.1557	0.2940	0.0210	-0.1126	0.0123	(0.8446)	0.1794	-0.0647	(0.8560)	-0.0126	0.1358
15 Doesn't give/gives energy for hours	0.1168	(0.5952)	0.1482	0.0096	0.1126	0.1740	0.3166	(0.5728)	0.1509	0.4909	0.3333	-0.0185
16 Not for infants/young people	0.4957	0.4060	0.1330	0.1480	-0.0296	-0.0481	0.5022	0.3896	0.1409	(0.7702)	0.1515	0.1059
17 For poor/old people	-0.0360	0.1467	-0.0901	0.2589	(0.7395)	0.3004	0.0960	0.0553	(0.7955)	0.1600	(0.8188)	-0.0933
18 Gives no idea of reality	-0.1127	(0.6850)	0.1482	-0.1462	0.0758	0.0136	0.2673	(0.6092)	0.1423	0.2553	0.3839	0.3249
19 Not for/for company	0.1536	0.1706	0.3367	-0.2422	(0.5205)	0.0335	0.7027	-0.1480	0.3125	(0.5174)	-0.0677	-0.1270
20 Not for/for me	0.2154	0.1091	(0.7338)	0.1601	-0.1810	-0.0154	(0.9418)	-0.1513	-0.0040	(0.7916)	0.0755	-0.1053
Sum	3.8878	4.7771	1.6263	0.1905	0.8296	1.9852	8.2299	7.6601	2.8811	7.7722	5.3227	2.1249
Sum of Squares	2.5059	2.6192	1.5083	1.5360	1.3635	1.3101	5.2360	4.5977	1.6925	5.0127	2.9363	1.5939

* Factors extracted by principal axis technique using component model with ones in the diagonal of the correlation matrix. Factors with eigenvalue > 1.00 were extracted and varimax rotation (MESA 1 Program) employed. The resulting orthogonal factors have been used for oblique factor solutions using bi-quartimin rotation program by Carroll. Figures in parentheses indicate moderately high to very high pattern loadings. Figures in italics indicate the variables used calculating composite factor scores for regression analysis.

skim milk acceptability has highest loadings for taste and liking by the entire family. In contrast, filled milk acceptability (F_{1f}) emphasized liking by adults and the entire family and also reflected a personal acceptability as can be seen from the test score of concept "Not for me—For me."

The second factor for regular milk emphasized nutritional test scores making it a nutritional factor (F_{2r}). In the case of filled milk, the nutritional dimension is superimposed upon the economic factor, thus making it an evaluative dimension (F_{2f}) with emphasis on calorie and price variables.

The third factor for filled milk and the second factor for skim milk have high loadings on the two utility test scores, "For thin people—For weight watchers" and "For poor people—For rich people," comprising the societal dimension (F_{3f} and F_{3s}). These two variables in the case of regular milk have emerged as two different dimensions labelled "health factor" (F_{3r}) and "economic factor" (F_{3f}). The "Not for—For me" test score associated with acceptability dimensions for filled milk and skim milk is associated with the health factor (F_{3r}) when applied to regular milk.

Calorie content has emerged as a separate dimension for skim milk, as expected, and has been labelled as "personal appearance factor" (F_{3s}):

The importance of the price test score for regular milk and skim milk is emphasized by identifying it as a separate dimension for these products. Also, economic test scores have emerged as a different factor in the case of regular milk. This may be interpreted to mean that for regular milk, price and economic factors are two different dimensions. This agrees with the previous results showing a highly inelastic price elasticity but responding to other socioeconomic variables such as family income.

The sixth factor for regular milk has one test score "Plain—Stylish drink" with very high loading and a knowledge test with moderately high loading. Therefore, this factor was labelled as "societal factor."

Inter-factor relationships and their socioeconomic characteristics^{5,6}

The diversity of milk consumption attitudes among the ethnic groups could be interpreted

⁵ Scott, in his earlier studies on milk demand in Honolulu and Kailua, traced the ethnic characteristics of de-

mand and the changes in their consumption pattern between 1958 and 1962. The present analysis, based on the three broad ethnic groups, follows the ethnic classification adopted in these studies [5 and 6].

Milk consumption by households

The quantities of regular milk, skim milk, filled milk, and total fluid milk consumed per week by the 214 households were regressed individually against the socioeconomic variables and the 13 attitudinal factor scores to study the impact of socioeconomic variables and the attitudinal factors on the consumption of individual fluid milk products under study. Stepwise regression has been used to select important variables. The regression for total fluid milk (including chocolate milk) consumed and total amount spent on fluid milk by households was also run for comparison. The analysis as-

Table 2. Correlations among certain socioeconomic variables and attitudinal factors

Correlation Among Variables ^a	Correlations for			Total Sample
	Caucasians	Chinese & Japanese	Others	
I. Socioeconomic variables:				
X_4 and X_5	0.508	0.447	.562	.499
X_5 and X_7	0.147	0.151	.422	.248
X_4 and X_7	0.458	0.511	.245	.466
X_7 and X_8	0.450	0.252	.408	.374
II. Consumption vs. socioeconomic variables:				
X_1 and X_4	0.388	0.547	-.325	.404
X_1 and X_5	-0.054	0.158	-.218	.005
X_1 and X_8	0.284	-0.044	.484	.281
III. Attitudinal factors for products ^b :				
F_{1r} and F_{1f}	0.436	0.331	.386	.389
F_{2r} and F_{2s}	0.741	0.768	.680	.731
F_{2r} and F_{2f}	0.442	0.704	.461	.540
F_{2r} and F_{3r}	0.416	0.380	.316	.371
F_{2r} and F_{3f}	0.325	0.061	.124	.180
F_{2s} and F_{3s}	-0.390	-0.305	-.312	-.336
F_{2f} and F_{3f}	-.508	-0.265	-.620	-.477

^a Variables are identified in the text.

^b The inter-factor correlations among the three fluid milk products are based on the factor scores computed as composite estimates.

mand and the changes in their consumption pattern between 1958 and 1962. The present analysis, based on the three broad ethnic groups, follows the ethnic classification adopted in these studies [5 and 6].

⁶ The interrelationships among the diverse milk consumption attitudes, the quantities of the different milk consumed, and the socioeconomic characteristics among the three ethnic groups were analyzed through correlation analysis before including them in the regression analysis. This section, apart from identifying the strong correlations, also indicates the inter-ethnic differences among the variables included in the regression model.

sumes the households as a basic unit for milk consumption.

The regular milk and filled milk regressions showed an R^2 of about .34 while for skim milk the regression yielded an R^2 of .25.⁷ The regression with total quantity of fluid milk consumed and total amount spent on food as dependent variables did not improve the results obtained from regressions with each individual fluid milk category and hence are not discussed here.

The regressions for regular milk (X_1), skim milk (X_2), and filled milk (X_3) are given below.⁸

$$X_1 = 1.21 + .245X_4 + .122F_{6r} - .113F_{1r} \\ (6.7) \quad (2.97) \quad (2.61)$$

$$(1) \quad -.233F_{1f} - .141F_{3f} \\ (6.32) \quad (2.53)$$

$$R^2 = 0.35 \quad F = 22.05 \quad S = 0.938$$

$$X_2 = .84 + .00058X_6 + .224X_8 - .084F_{3r} \\ (1.76) \quad (2.44) \quad (1.74)$$

$$(2) \quad + .081F_{5r} + .121F_{1r} - .84F_{2r} \\ (3.09) \quad (3.9) \quad (2.42)$$

$$R^2 = 0.22 \quad F = 9.6 \quad S = 0.625$$

$$X_3 = -.84 + .225X_4 - .29X_6 + .428X_7 \\ (5.31) \quad (1.96) \quad (2.62)$$

$$(3) \quad + .31F_{1f} - .183F_{3f} \\ (7.43) \quad (2.77)$$

$$R^2 = 0.33 \quad F = 20.8 \quad S = 1.70$$

where:

X_1 =quantity of regular milk consumed per week by household (in gallons)

X_2 =quantity of skim milk consumed per week by household (in gallons)

X_3 =quantity of filled milk consumed per week by household (in gallons)

X_4 =number of persons in household
 X_5 =employment status—housewife, employed=1; unemployed=0
 X_6 =household income
 X_7 =ethnic origin, Caucasians=1; Others=0
 X_8 =ethnic origin, Chinese and Japanese=1; Others=0
 F_{3r} =regular milk—health factor
 F_{5r} =regular milk—economic factor
 F_{6r} =regular milk—societal factor
 F_{1r} =skim milk—acceptability factor
 F_{2r} =skim milk—societal factor
 F_{1f} =filled milk—acceptability factor
 F_{3f} =filled milk—evaluative factor
 F_{3r} =filled milk—societal factor.

The least squares fit for weekly regular milk consumption of households has yielded parameter estimates consistent with theoretical expectations. While the number of persons in the household has a positive influence, their attitudinal factors entering into the regular milk consumption equation have negative coefficients. The regressions with quantities of skim milk and filled milk consumed by households as dependent variables have not always conformed to the general expectations of the impact of attitudinal factors on consumption. The impact of socioeconomic variables and attitudinal factors on consumption are discussed in the subsequent paragraphs.

Impact of socioeconomic variables on milk consumption

Regression analysis indicates that consumption of regular milk per household tends to increase with an increase in the number of persons in the household. This holds true in general irrespective of income, ethnic origin, and any other socioeconomic characteristic of the households.

Skim milk consumption, on the other hand, is correlated to the income level but the coefficient is not significant at the 5 percent level. In addition, the dummy variable representing Orientals has emerged significantly at the 5 percent level indicating that compared to the total sample, this ethnic group has a relatively higher level of skim milk consumption. This is consistent with the results obtained from the correlation analysis of consumer attitudes for different ethnic groups in the previous section.

Filled milk consumption, like regular milk, is also positively correlated to the number of persons in the household. The consumer at-

⁷ While the R^2 seems to be low, it shows a considerable improvement over the previous consumption functions estimated for Oahu by El Feel, who used the socioeconomic variables alone when he obtained R^2 of .11 for regular milk and skim milk, respectively [2, p. 86].

⁸ The values of the determinants for the correlation matrices of the three regressions were .909, .766, and .899. Both F_{2r} and F_{1r} have appeared with coefficients significant at 5 percent in the first two regressions but due to their high correlation (.75) for all ethnic groups, F_{1r} has been dropped in these regressions. The determinants of correlation matrices with both the variables were .415, and .323, respectively. The t -values are given in parentheses.

titudinal factors analyzed in the previous section indicated a favorable price-induced disposition toward filled milk among Caucasians. The filled milk consumption equation showed a significant preference among Caucasians for this product as compared to the rest of the sample. In addition, the negative coefficient of a variable representing employment status of the housewife indicated that gainful employment of the housewife tends to reduce the household's consumption of filled milk. For the "Other" ethnic group this variable (employment status of homemaker) is closely correlated to family income, which suggests that this group's demand for filled milk is income-oriented. It could also be argued that at higher income levels this group would tend to reduce filled milk consumption. In contrast, the Oriental ethnic group tends to move from regular milk to skim milk with increased income as indicated in equation (2).

Impact of attitudinal factors on milk consumption

The impact of the attitudinal factors on the consumption of the three fluid milk products is analyzed in this section. The quantity of regular milk consumed by the household is positively affected by the consumer's scoring of the societal (F_{6r}) factor of regular milk. As expected, a greater acceptability scoring for skim milk and filled milk will have a negative impact on the quantity of regular milk consumed. The evaluation factor for filled milk has also emerged as a significant variable in this context. Thus, if filled milk has received high acceptability and evaluative scores, it is likely to be used as a substitute for regular milk.

The impact of the skim milk acceptability factor and consumers' attitudes toward substitution of skim milk for regular milk could be better understood from equation (2). The regression with skim milk consumption as the dependent variable shows the negative effect of the health factor (F_{3r}) for regular milk which is expected. But less easily explained is the positive influence which the economic factor (F_{5r}) associated with regular milk has on skim milk consumption. This suggests that skim milk has some economic advantage over regular milk with consumers which in turn is borne out by the fact that skim milk commands a lower price than regular milk. Among the skim milk attitudinal factors, the acceptability factor (F_{1s}) shows a positive influence while the

societal factor (F_{2s}) has a negative influence on household consumption of skim milk. Although the economic factor associated with regular milk and the societal factor related to skim milk have the same salient test score (for poor/rich people) in the composite factor scores, they represent different dimensions as indicated by the factor labelling, which is also reflected in the regression. For instance, those who score high on the regular milk economic factor (F_{5r})—meaning that regular milk is for rich people—tend to look for skim milk as a substitute. At the same time, the skim milk consumption equation shows that a high rating of the societal factor (F_{2s}) related to skim milk does not imply increasing skim milk consumption. This contradiction may be explained in part through (a) the absence of any significant slimming and health variables in equation (2) and (b) the fact that Orientals who tend to consume more skim milk do so for reasons other than for slimming. The negative parameter for the health factor (F_{3s}) in skim milk consumption also reinforces this argument.

The filled milk consumption equation shows that it is significantly affected by consumer attitudes on filled milk alone; attitudes toward other fluid milk categories are not significant and hence do not appear in equation (3). The filled milk evaluative factor (F_{3f}), which is based on caloric content and price, has also not emerged as a significant factor in the equation. However, a high rating of this factor as it appears in equation (1) has a significant negative influence on regular milk consumption. On the other hand, acceptability of filled milk is still a factor in its consumption. Another important feature is that the societal factor for filled milk has a negative impact on its consumption. This is similar to the impact that the societal factor related to skim milk has on its consumption.

An overall assessment of the impact of the attitudinal factors on the consumption of fluid milk products leads to certain practical conclusions on the demand for these products, the consumers' attitudes and the expectations of the dairy industry. Acceptability factors for skim milk and filled milk are very important not only for the consumption of these two products but also for their substitutability for regular milk. Promotion of regular milk consumption could be achieved through emphasis on the nutritional value of milk (which reduces skim milk acceptability since they both are

highly correlated) and would be aided by better product familiarity in terms of the differences between the three products.

Skim milk is preferred to the other categories by the Oriental ethnic group and income has a low impact on its consumption. Even a high evaluation of nutritional and health factors for regular milk will not deter increasing skim milk consumption as income increases. Within this group the correlation analysis indicates that filled milk directly competes with regular milk among the Caucasian and "Other" ethnic groups for two different reasons. The Caucasian per capita consumption of fluid milk at .586 gallons per week is higher than that of the Oriental and "Other" ethnic groups (.45 gallons and .42 gallons, respectively). For this reason, the substitution of filled milk for regular milk among Caucasians is price-induced. For the "Other" ethnic group, it is because of their low per capita income level at \$38.4 per week compared to \$78.40 for the Oriental and Caucasian groups, respectively, in the sample.

Assumptions of the analysis

The foregoing analysis has been made under assumptions of static market conditions and consumer attitudes. Limitation of a study of this type due to the constant exposure of the consumers to new information should be recognized. As information available on the products either is disproved or becomes more concrete, a person's attitude toward a product may change to reflect the new knowledge. Consequently, conclusions drawn under these circumstances may not be appropriate for prediction.

The analysis assumes the household as the basic unit and the household respondent (usually the housewife) as the decision maker reflecting the consumption patterns and attitudes of the total household.⁹

The analysis takes into account the three major fluid milk categories—regular milk, skim milk, and filled milk. Recombined milk also was included in the survey but the results

showed a very poor knowledge and awareness of the product among various consumers and therefore was dropped from the study. Consumers of powdered milk and non-consumers of milk who constituted 9 percent of the sample were not included in order to limit the analysis to attitudes of fluid milk consumers.

Applicability of component factor analysis in market research

The traditional demand analysis emphasizing price-quantity relations does not take into consideration the attitudes and tastes of the different segments of the market explicitly, except on a *ceteris paribus* assumption. The one plausible argument is that tastes and preferences are subjective and do not lend themselves to quantitative interpretation. Ironically, these are the very consumer tastes and preferences that the firms seek to mold to promote their sales through advertising and product promotion. As a consequence, advertising and promotional efforts have not been geared to the proper segments of the market and have therefore failed to obtain maximum returns to the advertising dollar.

The methodology adapted in this paper was designed to bring the product demand into proper perspective and to delineate positive and negative attitudes toward closely related groups of products among the different segments of the market. The three important fluid milk categories—regular milk, skim milk, and filled milk—have been studied to analyze consumer attitudes of the three ethnic groups towards them and their impact on demand. In the process the price-quantity relationships which have hitherto been the mainstay of practicing economists and marketing specialists have been deemphasized.

The study has developed the patterns of milk demand among the three equally important ethnic segments of consumers in the Honolulu metropolitan area. It has demonstrated that nutritional and health considerations are working against filled milk consumption among the Chinese and Japanese (Oriental) ethnic groups and that economic and price factors tend to increase filled milk consumption among the other two ethnic segments.

Apart from the ethnic differences, the image of regular milk as a stylish drink (societal factor F_{6r}) is the main factor significantly favoring its consumption. Acceptability factors for skim milk (F_{1s}) and filled milk (F_{1f}) represent

⁹ The analysis indicated that the ethnic origin of the head of the household is an important factor in the fluid milk consumption pattern, although it is the housewife who makes the purchases most of the time and also forms 68 percent of the sample households interviewed. This shows that the attitudes of individual family members interviewed adequately reflect the attitude of the household and that the head of the household has strong influence on what is consumed in the family.

attitudes that adversely affect regular milk consumption through substitution. Consumption of filled milk, however, depends more on economic factors. The attitudes that affect filled milk consumption in general are its own acceptability by consumers (positive effect) and its societal image (negative effect).

The public implications of these results will be apparent when all three products under analysis are subject to government control and regulation in terms of production and distribution as in Hawaii. Assuming the state's objective is to promote consumption of fresh milk over filled milk, then this analysis identifies the economic factors hampering increased regular milk consumption among other ethnic groups and a special milk stamp program could augment their consumption. The approach for

the Oriental ethnic group is based on acceptability and calorie images of the product which justify continuation of the present milk supply program to the schools. However, apart from any promotional measures that could be thought of, consumption of regular milk by the Caucasian ethnic group is highest and its penchant for filled milk is price induced. Proper consumer education on nutritive and health aspects of consuming regular milk is perhaps called for in this case.

It appears that component-regression analysis has brought into light the different facets of consumer tastes and preferences in addition to the impact of socioeconomic variables that have implications both to marketing specialists and government agencies involved in the dairy industry in Oahu.

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Appendix Table 1. Mean values of consumer attitudes and impressions for various categories of fluid milk, 1970

Variable No.	Description of Experimental Variable (1-7 coding)*	Mean Scores		
		Regular Milk	Skim Milk	Filled Milk
1	Never heard— <i>knows</i> product very well	6.38	5.29	4.60
2	No vitamins—full of <i>vitamins</i>	5.90	4.26	3.83
3	Not liked—liked by <i>children</i>	5.74	3.01	3.42
4	Tastes bad— <i>tastes</i> good	6.07	3.93	3.56
5	Low in calories—high in <i>calories</i>	5.67	1.79	3.17
6	High priced—low <i>priced</i>	2.33	3.56	4.52
7	Not nutritious—very <i>nutritious</i>	6.02	4.42	3.73
8	Not liked—liked by <i>adults</i>	5.65	4.28	3.44
9	Low—high in <i>protein</i>	5.96	4.28	3.79
10	Watery— <i>rich</i>	5.51	2.38	2.97
11	Plain drink— <i>stylish</i> drink	3.19	2.46	2.33
12	Poor value—good value for the <i>money</i>	5.26	4.39	4.17
13	For thin people—for <i>weight watchers</i>	2.92	5.98	3.43
14	Disliked—liked by <i>entire family</i>	5.69	3.52	3.30
15	Doesn't give—gives <i>energy</i> for hours	5.16	3.88	3.49
16	Not refreshing— <i>refreshing</i>	5.94	4.32	3.78
17	For <i>poor</i> people—for <i>rich</i> people	4.40	4.00	2.43
18	Gives no vitality—gives lot of <i>vitality</i>	5.09	3.77	3.41
19	Not for company—for <i>company</i>	4.11	2.84	2.49
20	Not for me—for <i>me</i>	5.09	3.45	2.53

* The tests have been scored 1-7 in order of bipolarity indicated.
Source: Consumer Attitudes Survey of Filled Milk, 1970.

Communications

A SECOND LOOK AT THE IMPACT OF DIFFERENTIAL ASSESSMENT OF FARMLAND AND CONSEQUENT TAX SHIFTING: COMMENT*

Twenty-one states now have laws permitting and encouraging property tax assessment of farmland according to its current use value rather than its ad valorem (based-on-market) value [1]. The stated intent of the legislative sponsors of these statutes is to preserve farmland and other open spaces in areas of rapid land development and/or suburban sprawl where rapidly rising land values (and corresponding property taxes) are an impetus to convert farmland to residential construction and other development yielding a greater return to investment.

In analyzing the impact of use value assessment legislation, two issues are salient: Will the application of use value assessment to farmland affect the land use patterns and the rate of land development? How will the burdens of local property taxes be redistributed if use value assessment legislation were adopted?

A recent article on the projected tax impact of use value assessment by C. T. K. Ching and G. E. Frick appeared in the November 1970 issue of this *Journal* [4]. The authors do not discuss the first issue, i.e., the effectiveness of use value assessment legislation on land development in rural areas. Other recent studies [2, 3, 7] also have insufficient data to analyze this land development and land use pattern issue. Ching and Frick instead focus on the tax equity issue: the shifting of tax burdens from one class of taxpayers to another because of use value assessment of farmland.

On the basis of an analytical model developed and applied to the state of New Hampshire, Ching and Frick concluded that adoption of a use value assessment program would result in only a slight increase (about 1 percent) in property tax rates of towns, and the shift in tax burden from program participants to nonparticipants would be relatively greater in the rural towns rather than in the more urban communities [4, p. 606].

Ching and Frick confined their analysis to New Hampshire, a state which recently (April 1972) adopted a program for differential taxation of farmland, subsequent to the authors' research. Ching and Frick sought to predict the possible tax impact in that state if such a statute were adopted. Connecticut, on the other hand, enacted an "open spaces" law in 1963 [5]. In contrast to a conclusion of Ching and Frick, the experience of Connecticut towns under the Open Spaces Act suggests that it is easier

in practice to absorb the shift in tax burden from participants to nonparticipants in the more rural rather than the more urban communities. Property tax liabilities of farmland participants will decrease in either case, though the average tax abatement for participants is 50 percent and greater in urban areas and 15 percent or less in rural areas.¹ Correspondingly, the increase in tax liabilities for nonparticipants is 1 to 2½ percent in urban areas and one one-hundredths of 1 percent in rural areas. Indeed, the issues of differential land assessments and the accompanying shift of tax burdens from one class of taxpayer to another are most acutely felt in the expanding urban-suburban communities.

Ching and Frick and others conducting studies dealing with the effects of use value assessment and taxation have compared tax adjustments and relative changes in average tax burdens *among* towns (counties). The more relevant tax shifting question—Whose ox is gored when use value assessment is applied?—actually occurs among the various taxpayers *within* a tax jurisdiction (e.g., town, county) as the overall tax burden is redistributed among property holders in the community.² This issue of shifting tax burdens within a specific tax jurisdiction is discussed in a later section of this paper.

Shifting of Tax Liabilities in Rural and Urban Towns

Ching and Frick assumed in their study that 50 percent of the landholders qualifying for use value assessment would participate in such a program. Second, they assumed that each participant would receive a 50 percent abatement of their current property taxes after the use value assessment. The researchers applied these assumptions uniformly to all of the rural and urban towns in their analytical

¹ Some tax terms should be clarified. We interpret "taxes abated" or "tax abatement" as used by Ching and Frick to mean the actual reduction in property tax liabilities realized by specific property holders because of participation in a special tax relief program. A participating property holder with a current annual property tax liability of \$1,200 who otherwise would have faced a tax liability of \$2,000 has realized a tax abatement of \$800, or 40 percent. One also can say that the property tax "burden" of this individual has been reduced 40 percent.

² Hady [6] in an article that calls for more analysis of this farmland assessment subject notes, "Similarly, data are needed on the distribution among types of landowners of tax reductions under differential assessment. . . ." Hady constructively catalogs the gaps in empirical work on differential farmland taxation; he does not attempt to provide further data.

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model of New Hampshire. By specification, rural towns have a greater percentage of taxable farmlands than do urban or developing suburban communities. If one assumes (as did Ching and Frick) that the property taxes for use value assessment participants in both rural and urban towns would be abated by a uniform percentage, then the fewer nonparticipants residing in rural towns would bear a greater tax burden than their counterparts in the more urban communities.

We must challenge the authors' working assumption of uniform tax abatement, i.e., 50 percent abatement of property taxes for participants in both rural and urban towns. The ad valorem value of property reflects its projected most profitable use in reasonably competitive markets. Investors and land developers "bid" competitively for farmland in urban and suburban towns with the intent of turning the farmland into home, industrial, or commercial sites. Therefore, the difference between the ad valorem value and the current farm use value is significant for parcels of "prime land" in these urban communities. The taxes abated for participants will be the difference between the previous town tax rate times the ad valorem assessed value and the revised tax rate (moderately adjusted upward for all property holders to compensate for tax relief under the "open spaces" program) times the lower farmland use value. Consequently, the percentage of tax abatement resulting from use value assessment in urban towns may be significantly greater for participating urban/suburban farmland owners than for rural farmland owners.

By contrast to the land development patterns occurring in urban/suburban towns, one may find little speculative demand for farmlands in some rural towns. In these instances, the current agricultural use of farmland is, in effect, its most attractive use as reflected in the real estate markets. Whether local assessors apply ad valorem (based-on-market) valuation or farmland use valuation, the differences in the two valuations may be insignificant. Though there may be relatively fewer non-eligible property holders in rural areas than urban areas (by specification), the insignificant differences in the valuation methods in the rural areas may result in less of an increase in tax rates (in percentile terms) in these rural towns than in urban areas.

Use Value Assessment and Taxation in "Evolving Suburban" and "Rural" Connecticut Towns

A study was conducted in mid-1971 on the actual experience within Connecticut towns as a consequence of the 1963 Open Spaces Act. A sample of towns was used because the state does not require reporting by towns of land enrolled under the program. In the absence of consolidation reports or other accounting, one must examine the assessor cards for every land parcel within towns to gather the requisite data on program participation. Selected for the study were 12 towns that contained varying amounts

of farmland and open spaces that could qualify for use value assessment under the provisions of the Open Spaces Act. Six of the twelve towns had grown rapidly during the past decade and were changing from rural to suburban communities. These six towns were classified as "evolving suburban" communities. The second category of towns included six communities that, despite some population increase between 1960 and 1970, were still "rural" in character in 1970 both by density and economic activity.

Relatively complete data were obtained on use value assessment and taxation in four of the six "evolving suburban" towns. Though not required by law, the assessors of these four communities maintained records including both the use value and the ad valorem (based-on-market) value figures for each parcel of farmland. However, in the other two "evolving suburban" towns (Somers and South Windsor), the assessors only maintained figures for the use value assessment of the farmlands which had qualified for participation under the Connecticut statute.

Analysis of the use value assessment and tax data in the "rural" Connecticut towns supports our argument that the shifting of the tax burden from participants to nonparticipants is minimal in these towns. Four of the six rural towns had traditionally assessed their farmlands at their use value before state legislation. This practice reflected the rural character of these communities. The Open Spaces Act therefore legitimized a general assessment practice operating in many rural towns of Connecticut [8]. Transaction prices in the few sales of farmland in these rural towns 1965-70 sustain the position of the local assessors that farm use value also approximates current market value.

The remaining two rural towns of Tolland and Columbia chose to assess all parcels of land on a strict ad valorem basis rather than the alternative farmland use formulas. Farmland owners therefore have to apply for the alternative farmland use assessment. In each of these two towns only a handful of landowners participated in the program, and the aggregate market value of their farmland under the Open Spaces Act is less than one one-hundredths of the total assessed value for each of the two towns. Since the differences between the use value assessments and the ad valorem assessments of participating farmlands in these "rural" towns were minimal, this may explain the general lack of interest among agricultural property holders in these "rural" towns in the Open Spaces Act and its provisions.

The adjustment in the tax mill rate in the "rural" towns where farmlands owners took "advantage" of the Open Spaces Act preferential assessment provisions was marginal (one-hundredths of 1 percent compensating mill rate increase), since the incentive to participate—the possible difference between ad valorem (based-on-market) valuation and farmland use valuation—was nominal or zero for most farm property holders.

The change in tax rates and the shifting of tax burden resulting from use value assessment in "rural" and "evolving suburban" Connecticut towns are exactly the opposite of the projected impact of use value assessment predicted by Ching and Frick in their Table 1 [4, p. 604]. The towns studied under the 1963 Open Spaces Act show that the percentage reduction in assessed property value and the consequent tax abatements vary significantly as towns change in character from rural to urban/suburban communities. The data show that use value assessment and tax abatements are of the greatest significance to participants in the "evolving suburban" towns and of the least consequence to participants in "rural" towns. Therefore, the policy implications of Ching and Frick for states considering the adoption of use value assessment legislation should be reversed. The Connecticut experience with use value assessment suggests that, in reality, it may be more difficult to absorb the shift in tax burden in the more urban/suburban towns than in the rural communities. As a group, "open spaces" participants in sampled urban/suburban Connecticut towns realize average tax abatements of 50 percent and more, while nonparticipants absorb a 1 to 2½ percent increase in mill rates. In the most rural towns, farm property holders (eligible landholders and participants) as a group experience zero or nominal tax reductions; therefore, the compensating tax rate increase borne by nonparticipants is a very small fraction of 1 percent.

Use Value Assessment and the Shifting of Tax Burden within Towns

All farm acreage may not have the same "use value," though the land is devoted to agricultural production. Assessors in Connecticut, for example, generally classify farmland by soil type to reflect varying farm use value, with adjustments in some instances for unique local soil conditions and cash

crop.³ It is plausible, therefore, that farm use value/acre may vary among property holders *within* a town (county). Second, all farmland within a given town is not in equal demand for development. The alternative development value of farmland will vary according to its proximity to highways and interstate routes, mass transportation facilities, new or proposed schools, shopping and service facilities, and its residential attractiveness, etc. Consequently, one can anticipate a variation in the differences between ad valorem value/acre and use value/acre for farmland parcels *within* the boundaries of each tax jurisdiction.

This variation in reduced property valuation resulting from the use value assessment provisions of the Open Spaces Act is shown in Table 1 for the four sample "evolving suburban" Connecticut towns. There is a significant range of dispersion in the reduction of valuation received by use value assessment participants within a single town. For example, the mean reduction in valuation for Enfield participants is 70.11 percent; yet approximately one-third of the participants there receive valuation reductions either in excess of 90 percent or less than 50 percent. The mean valuation reduction figure for the lowest 10 percent of the participants is 27.97 percent. The average valuation reduction among the highest 10 percent of Enfield's participants is 93.84 percent.

Enfield and Glastonbury are the "most urbanized" (population density and economic activity) of the 12 towns surveyed. The very high ranges of reduced assessments and tax abatements among participants in these two towns again substantiate the proposition that there are more significant differences between the ad valorem value and the use value of farmlands

³ The Connecticut Extension Service recommends capitalized use values for four classes of farmland: Tillable A (shade tobacco, intensive nursery, turf); Tillable B (binder tobacco, vegetables, potatoes, extensive nursery); Tillable C (forage crops and cropland pasture); Permanent Pasture

Table 1. Variations of percentage tax base reductions within sample Connecticut towns, 1971

Evolving Suburban Towns; in descending order of population density and population increases	Reduction in valuation for participating land; mean of individual participants ^a	Standard Deviation	Range: average of lowest 10 percent of reduced valuations	Range: average of highest 10 percent of reduced valuations	Compensating increase in town Mill Rate
			Percent		
Enfield	70.11	20.91	27.97	93.84	2.53
Glastonbury	75.66	22.44	28.29	99.02	1.83
Bolton	60.76	23.97	28.10	87.19	0.14
Windham	43.34	16.73	21.20	68.97	0.08

$$^a \text{ Calculated as } \bar{x} = 100 - \frac{\sum_{i=1}^n (U_i/V_i)}{n} 100;$$

where U_i = use valuation
 V_i = ad valorem valuation
 for each respective parcel of participating land.

in the "evolving suburban" towns than in the "rural" towns. The highest 10 percent of the participants in Glastonbury received valuation reductions averaging 99 percent. For example, farm and forest land with a market value of \$12,000/acre may be reassessed under the use value procedure to a value of \$120/acre. Upon actual examination of the property, these lands generally are small "frontage" parcels with desirable road access and/or are attractive for commercial or industrial development.

The Connecticut data indicate that the impact of differential assessment of farmlands upon assessed valuation, increased mill rates, and the accompanying shift of tax burdens *between* and *among* participants and nonparticipants in any one town is most adverse for taxpayers in the more urban/suburban communities. The differential assessments and the

shifting of tax burdens may be the natural consequence of use value legislation. However, the greater the disparities in the tax burdens of property owners *within* a single community, especially with increasingly strident opposition to the property tax, the more likely it is that use value assessment legislation may become an abrasive tax issue. The "social benefit" claimed by proponents of "open spaces" legislation is an abstract concept. Conversely, the changing pattern of tax incidence *within* each community because of an "open spaces" law may be all too specific and visible to property holders whose tax burdens have been variously affected.

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A SECOND LOOK AT THE IMPACT OF DIFFERENTIAL ASSESSMENT OF FARMLAND AND CONSEQUENT TAX SHIFTING: REPLY

We accept the Schoepleins' challenge by contending that our research procedure is justifiable. The purpose of our paper was to analyze a nonexistent but pending use value assessment law. Under this condition, we attempted to use all available information and make seemingly reasonable assumptions. The Schoepleins challenge our assumption of a uniform (but variable in a parametric sense) abatement rate. We would have gladly relaxed this assumption had information on abatement rates for all townships been available. However, given the nature of our research problem, uniformity was the only reasonable assumption. The Schoepleins contend that due to the impropriety of this assumption, our conclusions are incorrect; that is, contrary to our conclusions, urban rather than rural towns will witness greater shifts in tax liability. We counter by pointing out that the empirical situations studied by the Schoepleins have several peculiarities which limit generalized economic conclusions.

Tax shifts due to use value assessment depend on three factors: the amount of total property valuation that qualifies for use value assessment, the amount of eligible assessed valuation that participates in the program, and the amount of taxes abated on the participating valuation. In our study we sampled towns of various sizes and on this basis estimated the proportion of a town's equalized valuation that would qualify for use value assessment, qualification being defined in terms of rural versus urban property. This proportion varied inversely with a town's population. We found, for example, that 25 percent of the smallest (rural) towns (by population) had a rural valuation ranging from 20 to 90 percent, while 20 percent of the largest (urban) towns had rural valuations below 4 percent. The amount of *eligible* valuation that participates in a use value assessment program depends largely upon tax abatements offered by the program. If, as in the rural towns alluded to by the Schoepleins, use value assessment

was "practiced" before enactment of the law, there is obviously very limited possibility for tax shifts. Taking this line of argument, we would expand the Schoepleins' conclusions as follows: those towns without use value assessment before enactment of a use value law will undergo larger shifts in tax incidence than those towns possessing use value assessment prior to its legalization. Shifts in tax liability are independent of the rural or urban character of a town, unless of course we accept the Schoepleins' implied definition of a rural town as one where use value assessment was in effect before enactment of a use value law.¹

It is not difficult to counter the conclusions implied by the empirical results suggested by the Schoepleins. We use the term "suggested" since only passing reference is made in the text to a comparison of evolving suburban towns and rural towns. As far as we were able to determine, no empirical results were presented for rural towns. However, we suspect that part of the reason for the Schoepleins' conclusions rests on the fact that tax abatement depended on the difference between use value assessment and market value assessment. While it is undoubtedly true that market values are greater in urban areas, as opposed to rural areas (for comparable types of property), we suggest that use value assessment should also be greater in urban areas than rural areas. Apparently in Connecticut, use value assessments, while variable with respect to fertility differences among properties, completely ignore locational differences, e.g., distance from market. This practice, of course, ignores the critical distinction between Ricardian Rent and Location Rent as defined by location theorists such as von Thunen.

If use values in rural towns reflected locational differences in property values, we speculate that differ-

ences between ad valorem and use values would be greater than those noted by the Schoepleins. Greater differences would tend to induce higher levels of participation among eligible property owners. And since rural towns generally have more eligible properties, tax abatement and, hence, tax shifts would logically be greater in rural towns than in more urban ones.

In retrospect, a major problem in implementing a use value assessment law involves specification of use values for all "open space" properties reflecting both fertility differences or site productivity and economic value due to location, which is an integral part of "use value." Conceptually, the problem is simple but practically insurmountable. Thus, it seems that if the intent of use value assessment laws is to encourage low population density land uses, one of two procedures is required: before implementing use value assessment, make sure all properties are assessed at market value; or, after certifying that all properties are assessed at market value, simply give tax abatements to all qualified participants on a flat rate reduction basis. The first alternative still involves specifying use values. The second alternative, the approach taken in our original paper, circumvents specification of use values and implicitly recognizes locational differences.

In summary, we are not willing to concede our position on the basis of the evidence presented by the Schoepleins. First, it seems that two observations (i.e., the two rural towns alluded to in the Schoepleins' study) are not sufficient to negate our seemingly logical conclusions. Second, it seems that there is something inherently wrong in computing the locational tax abatements on the basis of a variable market value but a fixed use value.

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OPTIMAL LEVELS OF FERTILIZATION UNDER RISK: COMMENT

In a recent article in the *Journal* [1], Alain de Janvry proposed a method of assessing the impact of risk in fertilizer application decisions. As the author notes, risk aversion on the part of farmers in less-developed areas may go far to explain why these farmers do not, and indeed *should* not, apply fertilizer at rates suggested by classic profit-maximizing

analysis.¹ de Janvry's article is a welcome and constructive contribution to the literature dealing with fertilizer use as it relates to the green revolution.

However, de Janvry's method of assessing the im-

¹ Though less of an issue, the same phenomenon is observed in developed countries (see, for example, Tollini and Seagraves [2]).

fact of risk does *not* do what it purports to do, that is, to determine the rate of fertilizer which maximizes expected profits, subject to the constraint that the probability of achieving a positive rate of return is at least 0.95. What his method *does* do is to determine the worst weather index likely to occur in 20 years and then to determine for the soil in question the rate of nitrogen which would maximize profits *given that value of the weather index*. The internal rate of return is then calculated for that level of nitrogen and that value of the weather index, and if the rate of return is negative, de Janvry concludes that the soil lies beyond the "fertilization possibility frontier" and does not "need" fertilizer.² This appears at first glance to be a plausible conclusion, since it does seem that if this were the result a farmer would fail to achieve a positive rate of return in at least 1 of 20 years and would thus by assumption consider the application of fertilizer too risky. But it is clear that the conclusion is in error, because if the farmer does not know in advance when the worst year in 20 will occur, he likely will not apply the amount of fertilizer appropriate to that year. Any other amount will result in even *worse* losses. In fact, the essence of this decision problem, as recognized by de Janvry, is to determine what amount *should* be applied to meet the probability constraint when the weather outcome is unknown. de Janvry's method offers no solution to the problem. It would be coincidental if the correct amount were the same as the profit-maximizing amount for the worst-of-20 weather situation, and in any other case the de Janvry procedure will overestimate the probability of positive returns for the given soil.

In order to find the expected profit-maximizing level of fertilizer, subject to the probability constraint previously mentioned, it is necessary first to establish a relationship between the level of fertilizer application and the probability that net profits will be negative. To do this, first note that given the soil characteristics, de Janvry's corn production function reduces to

$$(1) \quad Y = aN^bR,$$

where Y is yield, N is nitrogen application, and R is the weather index. Assuming, as does de Janvry, that yield without nitrogen is equal to aR and ignoring interest rates for simplicity, the expression for the internal rate of return is

$$(2) \quad IRR = \frac{P_y a N^b R - P_y a R - P_n N}{P_n N}.$$

Since R is a random variable, IRR is also random and

$$Pr\{IRR < 0\} = Pr\{P_y a N^b R - P_y a R - P_n N < 0\}$$

² This is an accurate description of his procedure as best I can determine it from the last paragraph of the section titled "Strategy." His previous three paragraphs lead one to expect something quite different, which is the reason I have stated that his method does not do what it purports to do.

or

$$(3) \quad Pr\{IRR < 0\} = Pr\{R < P_n N [P_y a (N^b - 1)]^{-1}\}.$$

Thus, the probability that the rate of return is negative is the same as the probability that the weather outcome R is less than the expression shown. From the frequency distribution of R , de Janvry was able to determine that value R_α^* such that the probability of an outcome R which is lower than R_α^* is $1 - \alpha$ (Fig. 1). Thus, we can state that

$$(4) \quad Pr\{IRR < 0\} = Pr\{R < R_\alpha^*\} = 1 - \alpha.$$

If the expression to the right of the inequality in (3) equals R_α^* , the probability of a negative return is exactly $1 - \alpha$. If the expression is any smaller than R_α^* , then $Pr\{IRR < 0\}$ is even less than $1 - \alpha$; so we can conclude that

$$(5) \quad Pr\{IRR < 0\} \leq 1 - \alpha$$

if and only if

$$(6.1) \quad P_n N [P_y a (N^b - 1)]^{-1} \leq R_\alpha^*$$

or

$$(6.2) \quad P_n N [P_y a (N^b - 1)]^{-1} - R_\alpha^* \leq 0.$$

The expression (6.2) can be solved for N only by numerical methods, but analysis of its derivatives indicates that it falls from $N=1$ to $N=(1-b)^{-1/b}$, after which it rises continuously, as shown in Figure 2. Since the probability constraint (5) is satisfied only when this expression is less than or equal to zero, it is clear that the only permissible levels of N are those between N_1 and N_u .

We can now see that the constrained maximization problem is to find the level N^* which maximizes profit and subject it to the constraint that $N_1 \leq N \leq N_u$. If N^* exceeds N_u , then N_u is the appropriate amount to apply. If N^* is less than N_1 , then N_1 is the appropriate amount. If N^* is within the limits, N^* is the appropriate amount. On the other hand, if for a given soil there are no values of N for which the expression in (6.2) is non-positive (the curve in Figure 2 lies entirely above zero), then there is no possible level of N which will satisfy the probability constraint. In this case fertilizer applica-

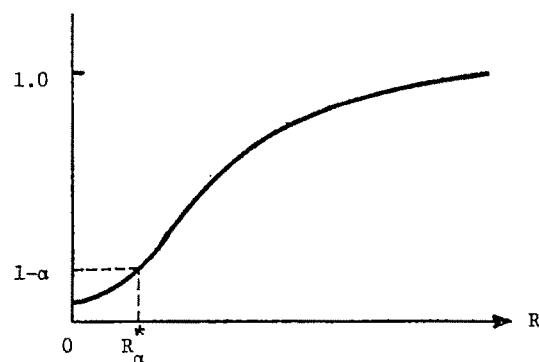


Figure 1. Cumulative distribution function of R

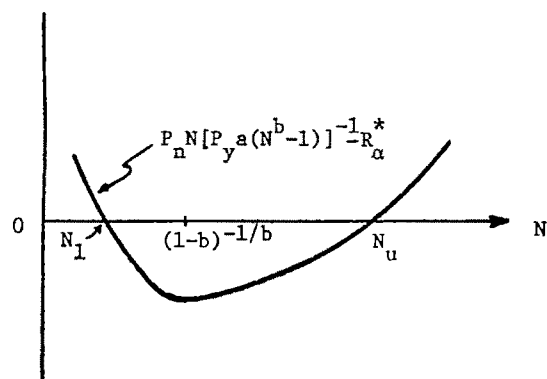


Figure 2. Application limits within which $\Pr(\text{IRR} < 0) < 1 - \alpha$

tion on the particular soil is too risky to meet the constraints and the soil should be considered outside the "fertilization possibility frontier."

The above-described procedure would result in the type of fertilization possibility frontiers which de

Janvry apparently had in mind. I certainly feel that the recommendations so derived would be an improvement on our expectations of farmers or recommendations made for them based on more traditional analyses. While equation (6.2) is difficult to solve, this is a characteristic of de Janvry's transcendental production function. For a quadratic function with interaction between R and N , equation (5) becomes an easily solved quadratic with much the same shape as shown in Figure 2.

One other criticism of the de Janvry approach (even with the above modification) is that only one source of risk is considered, that deriving from the weather index. A second source that should be included in the above probability calculations is experimental error, which must contribute substantial yield and rate of return variability since R^* was .77. There is no conceptual problem in incorporating this source or risk, but the computational burden will increase.

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OPTIMAL LEVELS OF FERTILIZATION UNDER RISK: REPLY

A general specification of the objective function for production under risk is given by the lexicographic utility function

$$LU\{\Pr[\text{IRR} \geq 0] = \alpha; \text{Max } U[m(\pi)]\}$$

where the priority goal is one of survival, and the secondary objective is the maximization of a preference function for profits where m is the vector of moments of the distribution of π . Let the production function be

$$Y = aN^bR$$

where both a and b are variable parameters that are functions, among other variables, of the soil characteristics. Let $F(R)$ be the estimated CDF of the weather index R .

As correctly stated by Richard Perrin, the fertilizer doses that satisfy the survival constraint are bound by the real and positive solutions N_1 and N_u of his equation (6.2). Considering for m the first moment only and assuming R to be the only stochastic variable, the fertilizer dose N_0 for a maximum of preference for profits is given by the first-order condition

$$N_0^{b-1} = \frac{P_n}{P_y b a R^*},$$

where R^* is the expected value of the weather index. The survival constraint will be met when $N_1 \leq N_0 \leq N_u$ and the recommended dose is then N_0 . When $N_0 > N_u$, $N_u \geq 0$ is the recommended dose. With $N_u < 0$, we are beyond the fertilization possibility frontier and fertilizer should not be used.

Contrary to what Perrin says in the second paragraph of his comments, the optimum fertilizer dose that I have recommended for application within the fertilizer frontier is N_0 , and not a dose

$$N_d = \frac{P_n}{P_y b a R_a^*}$$

that maximizes profit with R at the "disaster" level R_a^* . I believe the text to be clear in this respect. Where he is absolutely correct is that there exists an interval of soil fertility immediately along and within the frontier where the recommended dose should be N_u instead of N_0 since $N_0 > N_u$. It turns out that, with the fits obtained, the function $N_u = f(M)$ is steep where it intersects the M axis; and consequently, this interval of soil fertility is small.

To avoid the need for numerical methods, let me illustrate this point with a quadratic production function with interaction between R and N as suggested by Perrin.

$$Y = a + bN - cN^2 + dM - eMN + fR + gRN$$

where all the parameters are positive. The survival constraint will be met for

$$N \leq N_u = \frac{1}{c} \left(gR_\alpha + b - \frac{P_\alpha}{P_y} - eM \right).$$

The fertilizer dose that maximizes expected profits is

$$N_0 = \frac{1}{2c} \left(gR^* + b - \frac{P_\alpha}{P_y} - eM \right),$$

while the "disaster" dose is

$$N_d = \frac{1}{2c} \left(gR_\alpha + b - \frac{P_\alpha}{P_y} - eM \right).$$

The $N_u(M)$, $N_0(M)$, and $N_d(M)$ schedules are plotted in Figure 1 for given prices. If M_u is the value of M for which $N_u = 0$ (that is, the fertilization frontier with a probability of α of positive return), M_m the fertilization frontier without survival constraint, and M^* the intersection of $N_u(M)$ and $N_0(M)$, then

$$M_u - M^* = M_m - M_u = \frac{g}{e} (R^* - R_\alpha),$$

which is positive.

According to Perrin, the optimum fertilization schedule which I would have recommended is HID , which is not what I did. What I actually recommended is ACD . As correctly pointed out by Perrin, what should be recommended is the schedule ABD .

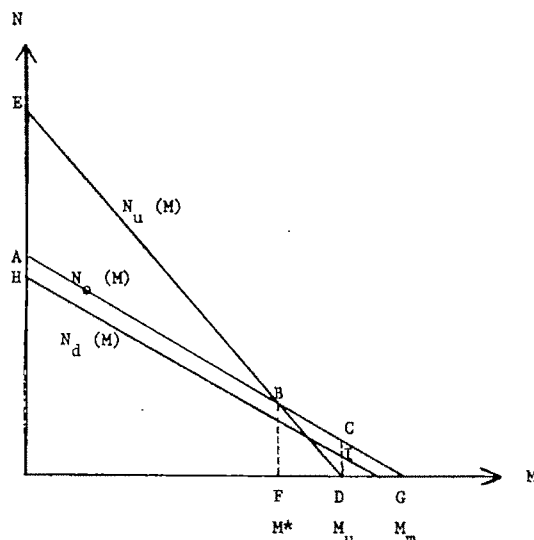


Figure 1. Optimum fertilizer doses with survival constraint

With e large, the slopes of the $N_u(M)$ and $N_0(M)$ schedules are steep, and the differences $M_u - M^*$ and $M_m - M_u$ small. Steepness of the $N_0(M)$ schedule near the fertilization frontier can be observed from the data in Tables 2 and 4 of the paper and with the quadratic above, $N_u(M)$ is twice as steep as $N_0(M)$. Differences between the schedules ABD , ACD , and ACG would then be minor.

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ECONOMICS OF CROPSHARE, ONCE AGAIN: COMMENT

In a very recent issue of this journal, Robert F. Boxley [3] maintained that cropsharing tenancy should not be construed as leading to an inefficient resource allocation in a perfectly competitive market where both the landlord and the tenant have economic alternatives for earnings. Thus, by implication, the inefficiency of share tenancy is solely attributed to market imperfections, and, according to Boxley, cost sharing "is not required for economic efficiency" under competition [3, p. 531]. Boxley's view seemingly is based on the line of reasoning given by Cheung [4; 5, pp. 16-29, 51-55].¹ He seems to aim

¹ Cheung's theoretical treatment of cropsharing is much more elaborate and comprehensive. But if one ignores such factors as transaction costs and risk in Cheung's model, the procedure of demonstrating that share tenancy under competition is efficient is about the same. I chose to take issue with Boxley's note simply because his geometrical illustration is easy to treat for criticism. Thus, the criticism of this note may be considered equally applicable to Cheung's original model.

at resurrecting Cheung's efficiency argument of cropsharing through a modified conceptualization of the problem. It is worth noting that like Cheung's, Boxley's view constitutes a clear departure from the traditional inefficiency argument against share leases that has prevailed since the days of Adam Smith.

It is the purpose of this note to demonstrate that Boxley's theoretical results have followed from his implausible definition of "opportunity return." When the concept of "opportunity return" under a cropsharing system is correctly interpreted, it can easily be demonstrated that contrary to his claim, share tenancy is inefficient in terms of resource allocation.²

Boxley's proof for cropsharing efficiency rests on the assumption that under competition the owners of land and labor have options for the earnings from

² If the level of input supplies or the cost-share feature is stipulated in the share contract, the inefficiency argument of cropsharing may no longer hold.

the uses of their input resources. Therefore, he claims that in competitive equilibrium the return on a factor supplied by the owner under one form of land tenure must be equal to what it could have received under an alternative arrangement, had it been employed in such alternative. Diagrammatically, he illustrates the concept of "opportunity returns" on land and labor inputs in Figure 1. The abscissa indicates labor per unit of land, and the ordinate is product per unit of labor.³ Line AQ_3 is drawn to represent the marginal value product of labor and line BC to indicate the prevailing wage rate at which the landless person can work either for the landlord or in some nonagricultural occupations. Boxley then thinks that point Q_3 establishes the equilibrium level of labor input for cases of the landowner cultivating land with the use of own or hired labor, or the tenant labor leasing land on a fixed rent basis. In each case area BAG becomes the total rent received by the landowner; area $OBGQ_3$ represents the total return on labor.

A cropshare lease, according to Boxley, is "only an alternative way of illustrating the allocation of factor returns in equilibrium" [3, p. 530]. If one ignores such factors as risk and transaction costs, all that is required is for both the landlord and the tenant to agree on relative shares so that both parties are paid their "opportunity returns." Again, diagrammatically, this requires determining the location of line DQ_3 in such a way that the output share to the landowner, as depicted by area $DAGK$, is equal to "opportunity return on land (area BAG)"; and the share to the tenant, as represented by area $ODKQ_3$, becomes equal to "opportunity return on labor (area $OBGQ_3$)."⁴

It is in the concept of "opportunity return" as

³ The diagram is reproduced from the Adam and Rask model [1].

⁴ Following Cheung [4, pp. 16-29], Boxley recognizes the possibility that the equilibrium solution requires the de-

used in his analysis that Boxley is in error. Given the availability of economic alternatives, the owner of a factor will ensure that his input resource is dispersed over many alternative uses in the way consistent with maximization of his total return. This implies that in equilibrium the returns on the marginal unit of his input from different uses must all be equal. For example, a laborer would choose to use his labor for cultivation on his tenanted land only to the point where the share of the marginal product of labor that he receives under cropsharing is equal to the wage rate per unit of labor prevailing elsewhere.⁵ In Figure 1, remembering that line DQ_3 can be taken as labor's marginal value product schedule after payment to the landlord of his share, we see that the tenant will supply only OQ_1 amount of labor per unit of land instead of OQ_3 , with the remaining work time devoted to wage-paid occupations. Thus, labor input employed on the tenanted land falls short of an optimal level in the sense that the marginal product of labor is higher than the marginal factor cost.

Although the marginal products of land or other tenant inputs are not shown in Figure 1, the implications of cropsharing tenancy for resource allocation are similar to those obtained for the case of labor. To maximize his income the landlord will allocate his land in such a way that the marginal unit of land from different uses yields the same rate of return. It follows then that in equilibrium the marginal product of land under own cultivation is equal to the share of the corresponding marginal product received by the landlord under a cropsharing lease. Inefficiency in the use made of land resource becomes evident in the sense that the marginal product of land in tenant farms remains higher than that in owner farms.

Most curious of all, Boxley considers it unnecessary, apart from land and labor, to deal with the case of other nondurable variable factors: fertilizer and seed, etc. Referring to the problem of a third input in the context of cropsharing, he concludes [3, p. 531]:

No further model modification is required to treat the other variable factors which the tenant is usually expected to provide. The fallacy in the traditional presentation of the model is the assumption that the tenant need consider only *his* interests in deciding how much of the variable inputs other than labor he is to supply.

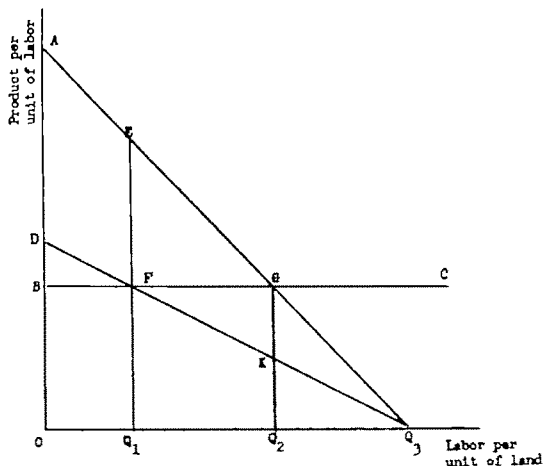


Figure 1. Illustration of the share rate determination when labor is a variable factor

termination of more than the share rate. For example, if the tenant and the landlord attempt to increase their earnings by restricting their input resource supply, the share rate must simultaneously be determined in conjunction with some land-labor ratio. Competition then ensures that in equilibrium each party receives income equal to his alternative earning. The complication introduced into the contractual process does not affect equilibrium properties.

⁵ Without loss of generality, leisure in this note is ignored as an alternative choice to the worker. For a mathematical treatment of the theory of tenant behavior, see Bardhan and Srinivasan [2, pp. 48-49].

Boxley's reasons for ignoring nondurable inputs in his analysis are unjustified. There seem to be no apparent reasons for treating nondurable inputs any differently from the case of labor which the tenant is also expected to supply.⁶ As long as a sharecropper has influence over the quantities of a nondurable input, it will be to his interest to have the marginal product of the input remain at a level higher than the marginal factor cost. This is the standard case of cropsharing inefficiency. The problem has been treated only recently in more analytical rigor by Adams and Rask [1], Gisser [6], and Bardhan and Srinivasan [2]. Even if we were to take Boxley's efficiency argument for cases of labor and land inputs at its face value, it is still true that insofar as nondurable tenant inputs are concerned, the level of commitment to tenanted farms remains lower than to owner farms and inadequate, with their marginal products higher than the associated factor costs.

In summary, Boxley's analysis is based on a situation in which the tenant and the landlord have only

the "all or nothing" type of choices in committing their input resources to alternative uses. Boxley's landlord and tenant each must commit all his labor to one form of land institution. This restrictive view of "choices" is responsible for his concept of "opportunity return" and for his theoretical result of equivalence of factor returns under share tenancy and under other forms of land tenure.

Empirical evidence aside, the postulate consistent with maximizing behavior in a situation where economic alternatives are available would be that the tenant or the landlord can disperse his input endowment over different uses. It has been shown in this paper that under this postulate Boxley's theoretical equivalence of factor returns no longer holds as an equilibrium. Thus, his claim that cropsharing is efficient in a competitive market is untenable. On the contrary, the inefficiency argument against share leases has been shown to hold equally with respect to labor and land inputs, as is clearly the case with nondurable tenant inputs.

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⁶ Perhaps one difference is that labor is usually not cost-shared.

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ECONOMICS OF CROPSHARE, ONCE AGAIN: REPLY

Kim is correct that my comment about cropshare leasing was based on the line of reasoning first presented by S.N.S. Cheung and that his view constitutes a clear departure from the traditional inefficiency argument against share leases that has prevailed since the days of Adam Smith. I find it curious, however, that Kim sees my comment as "resurrecting" Cheung's efficiency argument. Of the references he lists, only Bardhan and Srinivasan acknowledge Cheung's work. They respond [1, p. 52] by noting that their conceptualization of the problem differs from Cheung's conceptualization but, in my opinion, this begs the question of which conceptualization is the preferred one.

Kim argues that my definition of opportunity returns is implausible; yet he assumes the same options facing the landlord and tenant as were implicit in my definition or as are generally implied in the neoclassical theory of the firm [2, p. 295]. Among other options, Kim would allow the tenant to spread his labor over several units of land or between cropshare and

wage employment, while the landlord may self-cultivate his land, lease it to one share tenant or to several. Despite this range of opportunities available to both parties to the contract, Kim argues that in equilibrium the tenant will supply labor only to the point where the share of the marginal product of labor that he receives under cropsharing is equal to the prevailing wage rate, and the landlord will allocate his land "in such a way that the marginal unit of land from different uses yields the same rate of return." He concludes: "It follows then that in equilibrium the marginal product of land under own cultivation is equal to the share of the corresponding marginal product received by the landlord under a cropsharing lease. Inefficiency in the use made of land resource becomes evident in the sense that the marginal product of land in tenant farms remains higher than that in owner farms." This last sentence is, of course, totally inconsistent with an equilibrium solution!

Kim's critique turns out to be circular in that it

merely restates the traditional model. I conclude, therefore, that Kim has succeeded only in pointing out anew the implausibility of the traditional model.

My original note was intended primarily to bring Cheung's work to the attention of this journal's readers. As Kim notes, and as I acknowledged, Cheung provides a much more detailed and elegant analysis than the simple graphics I presented. Basic source documents have previously been cited; those interested in the issues may want to consult them and form their own judgments. Kim raises several specific points, however, that do require a response.

Kim says: "A cropshare lease, according to Boxley, is 'only an alternative way of illustrating the allocation of factor returns in equilibrium.'" From the context of my quote, Kim apparently is referring to the partitioning of total returns by line DQ_3 in (Kim's) Figure 1. I used the word "alternative" in the sense of "either-or." That is, one can illustrate the allocation of factor returns either in terms of areas of triangle BAG and rectangle OBG Q_3 of Figure 1 or in terms of the areas DAGK and ODK Q_3 . To repeat, the source of confusion in the traditional presentation is in superimposing the two illustrations of factor allocations on one graph. But there is still only one *marginal* value product schedule (line AQ_3). Line DQ_3 has significance only as it illustrates the division of *total* value product.

Kim says: "Most curious of all, Boxley considers it unnecessary, apart from land and labor, to deal with the case of other nondurable variable factors . . ." and then supplies a quote in which I say nothing of the sort. I said that, "No further model

modification is required to treat the other variable factors which the tenant is usually expected to provide." I meant simply that Cheung's model, based on bargaining between parties to a mutually agreeable contract, could be used to explain the allocation of any productive input supplied by the parties to the agreement. On the principle of parsimony, this model seems preferred to the traditional model which considers only a non-labor variable input, leaving questions of labor allocation to be determined outside the model.

Kim says: "Empirical evidence aside. . . ." He does not specify which evidence he wishes to set aside, but my reading of the literature suggests that the weight of empirical evidence fails to support the traditional model. But I agree. Let us set aside evidence and graphs and pose the issue as succinctly as possible. Traditional theory says that the cropshare lease is inefficient. Because it is inefficient, total product from the land unit must be less than it would be under alternate institutional arrangements implicitly available in a competitive economy. Because total product is less, either the tenant, or the landlord, or both receive less returns than they could under alternative institutional arrangements. Yet, share leasing persists. I submit that the explanation of the paradox lies in faulty theory and that Cheung's model is preferred for its consistency with observable experience.

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AN ANALYSIS OF THE MARKET FOR FOOD STAMPS: CORRECTION AND EXTENSION

Papers for annual meetings, like some wines, need aging. Unfortunately, production and bottling sometimes are hurried and, consequently, imperfections slip in. So it was with my paper, "An Analysis of the Market for Food Stamps," which appeared in the May 1972 issue of the *Journal* [1].¹ This communication corrects an error in the translation of the economic argument into mathematics by changing the model to have it refer to the aggregate participation of people rather than of families. It also extends the

empirical analysis of the price structure of food stamps to more household size classes than were considered in the original paper and to a consideration of the price changes that have occurred in the wake of Secretary Butz's suspension of the 1971 price structure on Jan. 16, 1972 [5]. The correction has the effect of completely reversing the conclusions that were drawn in [1] about the objective function (the goals) of the Food and Nutrition Service (FNS).

I argued in [1, p. 308] that: "After hunger and malnutrition became politically important, however, the FSP [Food Stamp Program] was increasingly viewed as an in-kind welfare program in which aggregate participation was the facet of importance." In

¹ R. J. Hildreth's suspicion of the pricing implications of the model made me redo the analysis and find the mistake in translating English to mathematics. I am indebted to him.

consequence, the appropriations revenue function, TR_a , should have aggregate participation as an argument for the post-1968 period. I also hypothesized that a *modified budget-maximizing bureau* would attempt to maximize its budget subject to cost while also attempting to follow the intent of Congress and maximize aggregate participation. In contrast, a *budget-maximizing bureau* would simply attempt to maximize its budget—revenue from appropriations plus the revenue from the sale of stamps—subject to the constraint that total minimum cost not be exceeded.

However, in translating English to algebra I took $\sum_i P_i$ to be aggregate participation, when in fact it represents the aggregate participation of *households* not of *people*. It is the aggregate participation of people rather than of households that I believe has been the concern of Congress. If n_i is defined as the size in numbers of people of households in household class i ($i=1, \dots, N$), then $\sum_i P_i n_i$ represents aggregate participation of people.

The correction can then be made by substituting $\sum_i P_i n_i$ for $\sum_i P_i$ in the appropriations revenue function (2) and in the post-1968 objective function for a *modified budget-maximizing bureau* (6). Corrected, these two functions appear as

$$(2') \quad TR_a = a \left(w_s Q_s, w_p \sum_i P_i n_i \right) \quad (i = 1, \dots, N)$$

and

$$(6') \quad \sum_i P_i n_i + \lambda^p [TC - TR], \quad \lambda^p < 0. \quad (i = 1, \dots, N).$$

Equation (2') represents the idea that prior to the political emphasis on hunger and malnutrition Congress granted appropriations to the Food and Nutrition Service (FNS) for the operation of the FSP in order to maximize gross farm income via maximizing the number of stamps sold, Q_s , ($w_s = 1, w_p = 0$). After hunger and malnutrition became politically important, Congress appropriated funds for the FSP in order to raise aggregate participation in the program ($w_s = 0, w_p = 1$). Of course, setting w_s and w_p alternately at 0 and 1 represent two extreme but nonetheless analytically useful positions. Congress could well take an intermediate position emphasizing one objective while not ignoring the other. Equation (6') represents the objective function of what I termed a *modified budget-maximizing bureau* and expresses the idea that the FNS followed the intent of Congress in attempting to maximize participation while also pursuing its own objective of maximizing its budget subject to total cost.

Given the corrections the pricing policies of the two types of bureaus—the *budget-maximizing bureau* and the *modified budget-maximizing bureau*—can be explored, contrasted with each other, and confronted with the actual prices charged for food stamps at various points in the FSP's history, as was done in [1]. The corrections do not alter the pricing policy of

Table 1. Relationship between family size, n_i , and the inverse of per person coupon allotment, n_i/\bar{q}_{si} , in the bases of issuance for the FSP, 1964, 1969, 1971, and 1972

Family Size, n_i	1964*	1969	n_i/\bar{q}_{si} 1971	1972
1	.049	.036	.031	.028
2	.052	.036	.033	.031
3	.046	.036	.034	.033
4	.051	.038	.037	.036
5	.054	.040	.039	.038
6	.058	.042	.041	.040
7	.061	.043	.043	.041
8	.065	.044	.044	.042

* Until December 1969 \bar{q}_{si} varied by income class within each family size. In consequence, n_i/\bar{q}_{si} for 1964 are simple averages over income classes within each family size.

Source: Bases of Issuance for FSP; Feb. 1964, Dec. 1969, July 1971, July 1972; FNS-USDA.

either type of bureau in the pre-1969 period. For comparison with the post-1968 policies, the equations representing the policies in the earlier period are repeated. If the FNS followed a *budget-maximizing* price policy in the pre-1969 period, then:

$$(4.1) \quad p_{si} = \frac{\lambda_s - a_s}{(1 - 1/\beta_i)}, \quad \lambda_s > 0 \quad (i = 1, \dots, N)$$

for each level of Q_s .² In contrast, if the FNS followed a *modified budget-maximizing* price policy in the pre-1969 period, then:

$$(5.1) \quad p_{si} = \left(\frac{1}{1 - 1/\beta_i} \right) [c_s + 1/N - a_s], \quad \lambda' < 0 \quad (i = 1, \dots, N).$$

The notation is consistent with that in [1].

If the FNS followed a *budget-maximizing* price policy in the post-1968 period, then equation (2') along with the equation for the revenue from the sale of stamps, TR_s , and the total cost function, TC , imply

$$(4.2') \quad p_{si} = \frac{n_i(\lambda_p - a_p)}{\bar{q}_{si}(1 - 1/\beta_i)}, \quad \lambda_p > 0 \quad (i = 1, \dots, N)$$

for each level of $\sum_i P_i n_i$.³ In contrast, if the FNS

² Equations (4.1) and (4.2') are obtained by maximizing

$$(4.3) \quad a(w_s Q_s, w_p \sum_i P_i n_i) + \sum_i p_{si} \bar{q}_{si} + \lambda_s [w_s (K_s - Q_s)] + \lambda_p [w_p (K_p - \sum_i P_i n_i)]$$

with respect to P_i where K_p and K_s are constants. To derive (4.1) from (4.3) set $w_s = 1$ and $w_p = 0$. To derive (4.2') from (4.3) set $w_s = 0$ and $w_p = 1$. This footnote is analogous to footnote 11 in [1]. Equation 4.3 in [1] had a typographical error in that the second term of the equation in footnote 11 was missing.

followed a *modified budget-maximizing* price policy in the post-1968 period, then equation (6') implies

$$(6.1') \quad p_{ii} = \left(\frac{1}{1 - 1/\beta_i} \right) \left[c_s + \frac{n_i}{\bar{q}_{ii}} (1/\lambda^p - a_p) \right],$$

$$\lambda^p < 0. \quad (i = 1, \dots, N).$$

In equations (4.1), (5.1), (4.2'), and (6.1')

p_{ii} = price of stamps charged eligible households in household class i ;

λ_s = total marginal revenue with respect to Q_s ;

a_s = marginal revenue of appropriations with respect to Q_s ;

β_i = absolute value of the price elasticity of the demand to participate in the FSP in class i ;

c_s = marginal cost of producing Q_s food stamps;

λ_p = total marginal revenue with respect to $\sum P_i n_i$;

a_p = marginal revenue of appropriations with respect to $\sum P_i n_i$;

\bar{q}_{ii} = quantity of stamps households in class i must purchase.

The price policies of both types of bureaus for each period imply the same kind of price-discriminating behavior: charge high prices to households with low elasticities and low prices to households with high elasticities. Since households with low elasticities have higher per person household income than those with high elasticities, the actual price policy of the FNS throughout the entire history of the program is consistent with any of the models (see Table 2).

In the pre-1969 period the price of stamps is independent of n_i and \bar{q}_{ii} according to the price policy of either type of bureau. Such is not the case in the post-1968 period: the price policies of both types of bureau imply that the price of stamps is dependent on both n_i and \bar{q}_{ii} . Indeed, in both cases the price of food stamps is dependent on the inverse of the per person coupon allotment, n_i/\bar{q}_{ii} . Table 1 shows the relationship between n_i and n_i/\bar{q}_{ii} in the 1964, 1969, 1971, and the 1972 actual price structures. As n_i rises, n_i/\bar{q}_{ii} rises irregularly in 1964; n_i/\bar{q}_{ii} is constant for household sizes 1, 2, and 3 and then rises as n_i rises in 1969; and a positive relationship between n_i and n_i/\bar{q}_{ii} exists in both 1971 and 1972.

Given that n_i/\bar{q}_{ii} is a positive function of n_i in the post-1968 period and assuming that households with the same per person household income exhibit the same price elasticity of demand to participate in the FSP, β_i , a clear test can be constructed to see which of the two types of price policies the FNS actually followed in the post-1968 period. This is so because p_{ii} is a positive function of n_i according to *budget-maximizing* behavior (4.2'), while it is a negative function of n_i according to *modified budget-maximizing* behavior (6.1'), given that n_i/\bar{q}_{ii} is a positive function of n_i and β_i is constant if per person household income is held constant. Note that equations (4.2') and (6.1') imply relationships between p_{ii} and n_i that are precisely *opposite* those implied by equations (4.2) and (6.1) in [1]. Thus, substituting aggregate participation of people for the aggregate participation of households is a crucial correction.

Table 2. Average price per stamp in FSP by per person household income and household size, 1964, 1969, 1971, and 1972

Per person household income per month	number of persons per household								number of persons per household							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
-----1964-----									-----1969-----							
0-19	.29	.28	.31	.31	.35	.36	.39	.40	.02	.03	.06	.07	.09	.11	.12	.13
20-29	.50	.49	.53	.55	.57	.59	.62	.62	.04	.20	.19	.22	.26	.29	.32	.34
30-39	.56	.57	.63	.64	.65	.68	.71	.70	.14	.30	.29	.34	.40	.44	.46	.48
40-49	.60	.64	.71	.70	.73	.73	.74	.74	.21	.40	.39	.45	.49	.53	.57	.58
50-59	.64	.67	.76	.75	.75	.76	.76	.75	.29	.49	.51	.57	.63	.62	.64	.63
60-69	.73	.75	.79	.77	.77	.78	.82	.80	.36	.55	.58	.66	.68	.68	.72	.70
70-79	.73	.72	.80	.78	.81	.84	.87	.87	.43	.64	.73	.72	.73	.74	.76	.75
80-89	.73	.77	.80	.80	.86	.90	.95	.93	.50	.64	.78	.75	.77	.78	.78	.78
90-99	.73	.77	.81	.85	.92	.96	1.00	1.00	.57	.64	.79	.77	.78	.78	.78	.78
-----1971-----									-----1972-----							
0-19	0	.03	.05	.07	.09	.09	.11	.12	0	.03	.05	.06	.08	.09	.11	.12
20-29	.03	.15	.19	.22	.25	.27	.29	.32	.03	.14	.17	.21	.25	.26	.28	.30
30-39	.13	.23	.27	.33	.38	.39	.43	.45	.11	.21	.26	.32	.36	.38	.42	.42
40-49	.19	.33	.38	.44	.47	.51	.54	.58	.17	.31	.36	.42	.45	.50	.52	.54
50-59	.25	.41	.49	.55	.61	.61	.65	.70	.22	.39	.47	.53	.59	.60	.62	.65
60-69	.31	.50	.56	.66	.70	.75	.82	.85	.28	.47	.57	.63	.68	.69	.73	.72
70-79	.38	.59	.70	.77	.82	.87	.92	.93	.33	.55	.67	.73	.74	.75	.78	.77
80-89	.44	.65	.77	.85	.91	.94	.95	.95	.39	.61	.73	.77	.78	.79	.79	.79
90-99	.50	.75	.88	.92	—	—	—	.95	.44	.69	.80	.79	—	—	—	—

Source: Computed from Basis of Issuance Tables for Feb. 1964 (Northern Issue), Dec. 1969, July 1971, and July 1972. Tables are truncated in that the source tables give prices for households of more than eight persons and for some higher income per person household income classes in some years.

Table 2 shows the actual price structures as they existed for food stamps in 1964, 1969, 1971, and 1972. The price of food stamps is shown by per person household income and for each household size class through eight-person households. The data in Table 2 are different from the data used in [1] in two ways. Previously, only data for household sizes through four-person households were used for 1964, 1969, and 1971. Table 2 covers twice as many household size classes for each year and also includes the data for 1972.

If one computes the average difference in the price charged households of size n_i and households of size $n_i - 1$, holding per person household income constant, the averages for each year are as follows:

1964 —	+.021
1969 —	+.041
1971 —	+.062
1972 —	+.053.

These figures represent average increases in p_{ii} given an increase of one in household size, holding per person household income constant.

It is clear from Table 2 and the averages above that as the history of the FSP has unfolded, a positive relationship between prices charged and household size, *ceteris paribus*, has developed which peaked in 1971 and fell off somewhat in 1972. The experience in the post-1968 period is clear: the FNS has followed a *budget-maximizing* price policy rather than a *modified budget-maximizing* price policy. This is exactly opposite the conclusion that was drawn from the analysis in [1] and reflects the change brought about by recognizing that it has been the aggregate participation of people not of families that has been the concern of Congress.

The evidence from the pre-1969 period is less clear. One can regard the slight positive relationship between p_{ii} and n_i (\$.02) in 1964 as (a) random error; (b) a disequilibrium situation reflecting the fact that the FNS in its first year of full operation of the FSP was not very knowledgeable of the demand situation it faced; or, (c) as reflecting the fact that even before the rise of the politics of hunger and malnutrition the FNS was pursuing a *budget-maximizing* price policy and Congress was, even then, somewhat concerned with aggregate participation but more concerned with farm income. My predilection after reading the history of the program is to reject alternative (c). The facts that the FSP had been running as an experimental program since fiscal 1961 and that the program was subjected to extensive analysis in its experimental days by economists cast some doubt on the likelihood of alternative (b). On the other hand, the raggedness of the relationship between household size and the per

person coupon allotment in 1964 (see Table 1) and the fact that the USDA studies [2, 3, 4] did not address themselves to questions of pricing policy, make alternative (b) more attractive as a rationalization of the pre-1969 experience. There is, of course, no evidence relevant to alternative (a).

It remains to ask why the positive relationship between p_{ii} and n_i became less so from 1971 to 1972 and what it means for the model. The change from 1971 to 1972 lowered the price of stamps for households in high per person household income classes and raises them slightly for those in lower per person household income classes. These changes actually return the price structure to almost what it was as of 1969. This was no accident. The Executive and the Senate Finance Committee forced the change from 1969 to 1971 in an attempt to reduce "the notch" implicit in the prices of food stamps. That is, participating families with incomes slightly lower than the income maxima for eligibility had total incomes (cash plus subsidy from stamps) greater than families who were ineligible because their incomes slightly exceeded the income maxima. Raising prices to the households with high per person incomes reduced the subsidy from stamps and reduced "the notch." In so doing, however, it raised stamp prices for the elderly and the urban poor, two groups which bulk large in the high per person income classes and which pack considerable political clout, enough clout that Secretary Butz revoked the 1971 price structure shortly after he replaced Secretary Hardin.

What implications has such activity for the model? It indicates that the appropriations revenue function of the FSP, TR_a , is a function of the participation of particular groups as well as of aggregate participation. The participation of particular groups can be important in year-to-year shifts in pricing policies. Over the long run the participation of subgroups of the population may be of less importance than total participation.

On the basis of the evidence of the post-1968 period, therefore, the model of the *modified budget-maximizing bureau* must be rejected in favor of that of the *budget-maximizing bureau* as an adequate representation of the behavior of the FNS. As shown in [1] the output and participation experience is consistent with both types of bureaus. The empirical support and judgment in favor of the *budget-maximizing* model is tentative, but it does rest on more complete data for the years 1964, 1969, and 1971 as well as an added year of data than was analyzed in [1]. Acceptance of the *budget-maximizing* postulate is attractive on the grounds that it is a simpler hypothesis than its alternative.

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NEEDED: MORE EFFICIENT USE OF COMPUTER RESOURCES

To allow cooperation and coordination and to prevent expensive duplication of effort among universities, compatibility of the software packages developed at various institutions is necessary. One of the primary features determining compatibility is the source language of the program. To determine the language or languages which should be used for maximum software compatibility among universities, a mail survey of all departments of agricultural economics in the United States and Canada was made. Sixty-one of sixty-three institutions returned questionnaires. Sixty of the sixty-one used computers. Respondents were asked to indicate the computer systems available, languages presently in use, and languages expected to be available and used in the future.

The Survey

IBM 360 computer systems were most predominant (Table 1). Nine institutions used CDC 6000 series systems. Four of these also had IBM 360 systems available.

Fortran was the only general purpose computer language which was available to all 60 departments (Table 2). Cobol was available to 90 percent of the institutions with PL/1 and Basic being available to approximately 70 percent.

Table 1. Computer systems available to agricultural economics departments, United States and Canada, 1972

Computer System	Number of Departments*
IBM 360 Series	46
CDC 6000 Series	9
Sigma	4
Univac	4
IBM 1130	3
Burroughs	2
PDP	2
Other	4

* Some departments used more than one computer system.

Most institutions did not expect additional languages to become available in the foreseeable future. Only three institutions expected to add a general purpose language to those presently available. Although the rapidly changing state of the art in computer science makes any statement about the future tenuous, this does indicate relative stability in the languages available at the present time.

Availability of a language at an institution does not mean that it is frequently used or well supported by computer and programming staff. Nearly all of the departments surveyed indicated that Fortran was the most important language currently used (Table 3). Fortran was the only language used in 42 departments. Only two departments indicated that PL/1 was the most important language. At all institutions where more than one language was important, Fortran was one of the important languages listed.

In looking into the foreseeable future, the relative importance of each of the languages is expected to be maintained. Only one university (University of Hawaii) expected the most important language to change from Fortran to PL/1. One other (Colorado State) planned to change from Fortran and Basic to Cobol. Four additional institutions expect PL/1 to become one of their important languages.

Table 2. Computer languages available to agricultural economics departments, United States and Canada, 1972 and future

Language*	Number of Departments	
	Present	Future
Fortran	60	60
Cobol	54	54
PL/1	44	45
Basic	41	42
Algol	31	32

* Minor use of a few other languages was reported.

Table 3. Most important programming languages used by agricultural economics departments, United States and Canada, 1972 and future

Language	Number of Departments ^a	
	Present	Future
Fortran	58	57
Cobol	6	6
PL/1	7	11
Basic	7	5

^a Sixteen institutions listed more than one language important at present and 15 expected more than one to be important in the future.

In total this survey indicates that Fortran is now, and is expected to be in the foreseeable future, the most important general purpose computer language used by agricultural economics departments in the

United States and Canada. The use of PL/1 is increasing slightly but remains comparatively unimportant.

Two important points are implied by the survey results. First, a program written in Fortran has the possibility of being used by all agricultural economics departments in the United States and Canada. Second, practically all departments have Fortran experience and capabilities. Their support staff will be able to handle the adaptation and modification problems that may arise in transferring programs.

Thus, agricultural economists developing computer programs which are or could be of use to other universities should seriously consider writing those programs in Fortran. Use of other languages will seriously limit the number of other institutions that can use the programs developed.

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Book Reviews

Ball, A. Gordon, and Earl O. Heady, eds., *Size, Structure, and Future of Farms*, Ames, Iowa State University Press, 1972, viii + 404 pp. (\$9.95)

This book, a product of the Center for Agricultural and Rural Development at Iowa State University, contains 20 chapters on topics relevant to changes in the size and organizational structure of U. S. farms, with emphasis on the 1960 decade. Each chapter was written by one or several well-known agricultural economists who had previously demonstrated an interest in the topic assigned through their earlier writings. In this reviewer's opinion, this is one of the Center's best publications and all agricultural economists should become familiar with its contents. Graduate students searching for thesis problems will find direct and indirect suggestions for a rewarding research experience. Administrators of agricultural research and educational programs can profit from reading at least the last chapter in which the editors provide what might be called a public policy prognosis of what is said in the preceding chapters.

Much interesting farm and agribusiness data are presented throughout the text, most of which is available in published secondary sources. But this is not a book of statistical description. The authors go beyond a presentation of various trends to analyses of factors that contributed to the changes in farm size and organization and how these changes have affected production efficiency, the welfare of rural communities, and the whole rural-urban structure of our society.

Large farms, those with \$20,000 or more annual gross receipts, have increased in number despite the drastic decline in the total number of farms. However, these large farms, which produce approximately 70 percent of the value of farm products sold, do not represent just a horizontal expansion of family farms by adding an additional tract(s) of land. Accompanying the increased size has been a shift of many activities to large-scale marketing and supply firms performed in vertical sequence. The farm-gate distinction between what is farming and what is processing and marketing no longer provides an adequate boundary that separates the farm and nonfarm

agricultural businesses in the production process. The gate swings open in both directions. Farming has become increasingly interdependent with other segments of the agricultural industry, so interwoven that a new concept of a farm is required if, indeed, the production process can be clearly divided between those who till the soil and tend the livestock and those who convert the raw materials produced into final products for consumption. Technological innovations gave rise to economies of size, but more important they often created situations in which it became necessary and profitable to transfer a greater proportion of the production process to nonfarm agricultural businesses.

It is this shift in activity performance that raises questions of vital concern. Examples of such questions are: Has the family farm been displaced as the dominant unit in farm production? Does a large economic sector composed of independent family farms give rise to social benefits above and beyond those derived from the supply of food and fiber that such a sector can be expected to provide? To what extent are managerial decisions made by farmers, producer organizations, input-supply firms, and large-scale food processing and marketing businesses? Should cost of production and allocative efficiency in farming always be the overriding factor in framing a public policy for a desirable structure in the food and fiber industry? How prosperous is an agricultural industry when only the upper 10 to 20 percent of the farms are achieving competitive resource returns? What will be the sources of equity capital if an investment of \$200,000 becomes the "lower bounds" for a third or more of our commercial farms? What are the social costs associated with declining populations in rural towns arising from fewer but larger farm businesses? In framing public policy, should more emphasis be placed upon distributive equity, population settlement patterns, and benefits and costs associated with the many social problems arising from our ever-expanding urban centers?

Discussion and analysis of questions like these provide the contributions of the authors of this book for a better understanding of our agricultural industry and its importance in the nation's economy. The

editors summarized the contributions most aptly:

Whereas the problems of farm size and work force were once mainly the property of the rural population, they now have much broader and deeper roots. The nation is richly endowed with space and food production capacity. Under these conditions where food production requires only a meager proportion of the nation's resources, should we allow market forces and farm programs to continue the depopulation of the countryside and the concentration of population in crowded urban centers? We are moving to a time when prospects of farm size and the population in rural areas pose much broader questions which cannot be solved merely in the framework of commercial farm policy as in the past.

This reviewer believes that all Americans need to acquire a better understanding of the interrelationships between what is happening in the rural and urban sectors of our economy. He knows of no better way to start acquiring this knowledge than to read the book reviewed here.

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Brubaker, Sterling, *To Live on Earth: Man and His Environment in Perspective*, Baltimore, The Johns Hopkins Press for Resources for the Future, Inc., 1972, xiv + 202 pp. (\$6.95)

Barkley, Paul W., and David W. Seckler, *Economic Growth and Environmental Decay: The Solution Becomes the Problem*, New York, Harcourt Brace Jovanovich, Inc., 1972, vii + 193 pp. (\$2.95) Paper.

Boulding, Kenneth E., Elvis J. Stahr, Solomon Fabricant, and Martin R. Gainsburgh, *Economics of Pollution*, New York, New York University Press, 1971, 158 pp. (Price unknown)

"The solution has become the problem." All of these books seem agreed that economic growth (material production) which has been billed as a solution to most social problems is now creating a problem itself. Population growth is also regarded as a contributor but secondary for the U. S. presently, although its future role cannot be exonerated.

Brubaker writes for the general reader and with a short, manageable book has succeeded in covering the physical and social science ingredients necessary "to live on earth" in an admirable fashion. He succeeds because of a thoughtfully developed classification scheme which culminates in a matrix displaying his system components. Environmental problems are classified by order of gravity from amenity niceties

to effects on earth's life support system. He then relates a series of considerations to these problems, including causative factors, problem threshold, area affected, management level, and institutional and technical alternatives. One comes away with a good understanding of the major trade-offs that must be made in environmental management. The book is tightly written and well indexed to facilitate recovery of information.

His middle position between the "doom and gloom" prophets and the "business as usual school" seems well supported by his evidence. Brubaker provides a very readable summary of the dimensions of the major hazards of erosion, fertilizers, pesticides, radioactivity, and man's effect on global climate. However, all of these authors note that our knowledge base is weak and that much uncertainty exists. I never cease to be amazed that a people who can go to the moon know so little about what they are doing to the basic natural systems that support life and health.

Brubaker's breadth of scope is illustrated by one of his concluding sentences: "... if we can turn to account the institutions and motivations that we have, make rational application of science and technology to our near-term problems, and simultaneously move toward a set of values and aspirations consistent with long-range occupancy of the earth, we can hope to surmount the crises."

Barkley and Seckler write for the university undergraduate and develop basic economic theory concepts to analyze environmental problems. They trade off inclusion of this economic tool material for some of the natural system information of the Brubaker book. This is a matter of degree and is not to suggest that economic concepts are absent from Brubaker or that Barkley and Seckler ignore natural data.

After beginning with a discussion of the relation of economic growth and the environment Barkley and Seckler move to a good elementary discussion of supply and demand, externalities, collective goods, and free rider problems. When the market fails, they throw benefit-cost analysis into the breach. Their description of cost effectiveness tools in exploring opportunity costs and trade-offs is excellent, but the contribution of economic science to the choice of alternative environments leaves this reviewer with mixed feelings.

Discussion of the Hotelling-Clawson method for valuation of recreation resources implies that in time economists will develop scientific, objective evaluation of other non-marketed goods which will save politicians the anguish of the subjective political process. The authors may deny that this was their message, but if it is not they must go out of their way to avoid this all-too-common implication. The recreation evaluation methodology is essentially a market valued deduction and holds no promise for goods where no such deduction or analogies are possible.

They say that the value for the aesthetic existence

of the blue whale, for example, "must be estimated on the basis of a more subjective measure of willingness to pay." This carries a strong suggestion that market-related values are objective and legitimate while political choice is tainted. But, both market and political choice are bounded by publicly chosen rules of the game which affect outcomes.

Their generally excellent discussion of conservation, irreversibility, and changing supply and demand is marred by an occasional lapse into the mythological claptrap of welfare economics. For example, "Unfortunately, resources are as often allocated in terms of political and economic power as in terms of efficiency." The implied normative superiority of economic science is not proven. It ignores who chooses what to be efficient about. Their occasional lapses can be overlooked after a very perceptive demolition of the traditional economic theory separation of the efficiency and distribution dichotomy. When the authors are explicitly discussing income distribution they are lucid and non-normative. For example, when analyzing effects of instituting charges at a city zoo they note, "No economist can say which is the 'correct' fee to charge or which is the optimum trade-off between visitation and revenue." I would have been completely satisfied if they had added—or whether the zoo should exist at all.

Barkley and Seckler conclude that lower rates of economic growth are necessary to protect the environment. They are quick to tie this policy to a minimum income for everyone whether they work or not. The authors do not fear the stationary state and, in fact, suggest it might be good for us. Apparently, the new solution will require non-marginal changes in peoples' habits and attitudes.

The *Economics of Pollution* collects the Moskowitz lectures of Kenneth Boulding and Elvis Stahr, president of the Audubon Society, with comments by two other economists. Coming from an environmental pressure group, the Stahr piece is notable for its economic logic (which is understandable when the author notes an economist co-writer). It is gratifying to hear a conservationist insist that we try to get the most pollution control bang for the buck. He presents the now standard economist's argument for the institution of charges for pollution control rather than the imposition of standards approach. Incidentally, this preference for user fees is also supported by Brubaker, Barkley, and Seckler, though they all emphasize a variety of institutions.

The Boulding contribution stands in contrast. His main theme is the need to develop better social indicators, to which the others would also agree. But, Boulding goes on to introduce some concepts seldom found in economic literature (Barkley and Seckler do note the Boulding theme). He speaks of "the image" and the process of learning. He is interested in syndromes of mutually interacting indicators. He does not just want to look at one variable and decide if it is better or worse, for some other variable may have been set in motion which will change it (or its

impact, including the human evaluator of that impact). Boulding does not seem ready to inquire of standards or charges until he sorts out some background questions first.

Elsewhere he noted that "the presence of pollution is a symptom of the absence of community." The public goods problem presumes a public which is seldom inquired of. Brubaker for example says, "whatever level of waste load we find acceptable the market can be used to allocate." But, who is "we" and how do groupings of these we's get formed along with their attitudes and how do opposing we's get compromised? Without a public or a community there can be no civilized discussion of either standards or charges. Unless we tend and husband the processes which influence people's definition of who is my brother there will be no participation in collective decisions. And, when decisions are made, there can never be enough police to control contrary behavior unless people learn to accept the collective rule as part of the internal definition of their personality.

In this reviewer's mind, most discussion of environmental institutions tends to be rather abstract proofs of the superiority of the approximate market model (user charges). There is a conspicuous absence of reference to empirical studies which warrant the asserted predictions of performance. In fact, there is not enough attention to Boulding's call for carefully constructed and aggregated social indicators of performance (and Brubaker's start at an inventory). It is almost as if economic theory had no real use for empirical reference points. The structure which allows Pareto-better trade gives the best of all possible worlds, whatever that world may be in actuality (or in different people's images). Or, does it?

Several of the authors note that in planning theory the socialist countries ought to do the best job of environmental management. They observe the contrary empirical evidence. If the planner's paradise has problems, how can we be sure that market-like charges are as simple and foolproof as our logic predicts? Shouldn't we also inquire into the bureaucratic systems administering these charges and other rules and the images of the people that respond to them? I know this all sounds messy to those who are content with the proposition that to change behavior all you need to do is to change relative prices and profits, but this is only part of the system.

The environmental economics literature is exploding along its own growth curve. Other contenders for texts include Thomas Crocker and A. J. Rogers, *Environmental Economics* (Dryden Press, 1971), Marshall Goldman, ed., *Ecology and Economics* (Prentice-Hall, 1972), and Edwin Dolan, TANSTAAFL, *The Economic Strategy for Environmental Crisis* (Holt, Rinehart and Winston, 1971). While all have excellent features, one gets the feeling that none have yet put it all together.

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Dorner, Peter, ed., *Land Reform in Latin America, Issues and Cases*, Madison, Land Tenure Center at the University of Wisconsin, Land Economics Monograph Series No. 3, 1971, xx + 276 pp. (\$3.95)

Reading this book was depressing but enlightening: depressing because it vividly emphasizes the critical and humanistic implications of deprivation in many rural-oriented countries and because a major policy tool, land reform, so often courted as a solution to maladjustments in income distribution and economic growth, has been relatively ineffective except through revolution. Disagreement is common about whether land reform has been given a fair trial and, when tried, if it has been successful. But regardless of the conclusion to these arguments, the results are depressing. The book is enlightening because it goes beyond land reform to other interdependent necessities for sustained and equitable growth. In that regard the title is restrictive, as, I am afraid, are the conceptions of many people about the topic of land reform. This book and the Land Tenure Center itself stem from numerous man-years of research, various technical assistance contracts, and, no doubt, many achievements and some failures. Each of the authors (seven in total) contributing to this book has drawn heavily upon the experience of many researchers not directly involved with the Land Tenure Center and, as a beneficial result, bibliographies are provided. For these reasons and if you are interested in problems of the less-developed countries and land use in general, I encourage you to read this book.

A key role of land in the development process is expressed in several stimulating contributions to the book by Dorner. In the introduction he states that "... land must be viewed as a vehicle for human development as well as a resource for food production" ... "as a vehicle for employing people" ... and "as a vehicle both for creating economic opportunities and upgrading the human skills and capacities required for their exploitation." This theme tends to penetrate the work of each contributing author, as I assume it was intended, and may over-emphasize the role that reform alone can play.

Part I (Chapter 1) opens with a brief and constructive criticism of economic analysis for agricultural development policy formulation. Dorner questions the validity of theories based upon U. S. institutions as guides to research in developing countries where institutions have often evolved along very different lines. This comment contributes to an emerging but as yet academic philosophy concerning research and technical assistance in developing countries. The authors, however, have contributed little specifically to suggesting a better and functional approach. Chapter 2 also questions attempts to categorize countries as groups of people according to various socioeconomic criteria. The author discusses the social significance of land tenure systems and ana-

lyzes their role in industrial, transitional, and traditional societies based upon conventional definitions. In so doing he fails to comply with his earlier comments and those of Dorner on the need for new analytical approaches better designed to meet the conditions of developing areas. His point, however, is well taken and worth consideration by those displaying the classification and definition syndrome.

A succinct presentation in Part II relates the need for land reform (distributive reform) to conflicts resulting from accelerated agricultural development efforts. It is here, in addition to the purely humanitarian goals, that land reform is most closely linked to economic development. The authors want to dispel the notion that small farms are, by their very nature, less productive than large farms, and emphasize that land reform policy should be addressed not only to the production problem but also to migration-related unemployment problems.

A major part of the experience cited concentrates on case studies in Chile, Bolivia, and Colombia found in Part IV of the book. Specific references to land reform legislation may burden some readers, as in the case of Chile where major reforms have occurred since President Allende replaced President Frei. In addition to illustrating the multitude of legal and political maneuvers found in land reform policy formation, the material in Part IV is informative in terms of how slowly needed policies are developed, instituted, and imposed for resolving humanitarian and growth problems. This may suggest why some peasants feel revolution is the only possible short- and long-run solution to problems so deeply founded in present institutions and systems. The Chile case, which deserves further study, and the major revolutionary upheavals in Bolivia lend support to this point.

The chapter on Colombia is particularly informative and comprehensive in its illustrations of the numerous needs for coordinated agrarian reform where land, market, social, and various other institutions must be transformed. Some of these important interdependent activities are neglected in the other case studies. The author recognizes that while the land reform institute fails to transfer fertile lands in large farms to small farmers, other reforms would be essential even with a successful land redistribution effort.

The three final chapters make a worthwhile contribution to the literature by discussing the various supplementary reform measures which often accompany, aggravate, and sometimes complement legal reform arrangements. These include peasant organizations, some of which have forced gentlemen's agreements with large landholders and others which have erupted into open and violent conflict. Land invasion, spontaneous colonization, and private reform efforts also contribute to land reform but they often become entangled with other critical problems. Tenure security and title system problems commonly ac-

company the supplementary reform measures. Again, the slowness and difficulty in instituting effective legal reforms are emphasized by the incidence of supplementary reforms.

If the book has a major strong point, it is that it will "whet" your appetite by suggesting some basic weaknesses in attempts at land reform and some general research and action needs. A weakness is that the authors in their separate chapters, aside from the introduction and conclusions to the book, may not have been bold enough in their criticism or aggressive enough in their suggestions for new approaches and solutions to the problems. I am sure further research is wanting and our profession, along with policy makers in developing countries, might help pursue possible solutions that are conjectural and possibly controversial. In recognizing the breadth of the rural-urban development dilemma and the numerous political, social, and economic conflicts, as well as accompanying interdependencies, the authors agree that land reform is but one necessary link in improving the lot of the urban and rural poor.

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Geer, Thomas, *An Oligopoly: The World Coffee Economy and Stabilization Schemes*, New York, The Dunellen Publishing Company Inc., 1971, xi + 323 pp. (\$10.00)

This book is primarily concerned with an examination of the market structure and conduct of the major world coffee producers and with an evaluation of certain of the effects of the International Coffee Agreement on the world coffee market.

The first two chapters include a brief discussion of arguments that have been made for and against the use of international commodity agreements, as well as an outline of general trends in world coffee production, prices, trade, and stocks since the 1940's. The importance of coffee to the exporting countries is pointed out and a discussion of the institutional arrangements for the establishment of international commodity agreements is presented, as is an outline of the major provisions of the International Coffee Agreement of 1962.

The third chapter is primarily concerned with outlining the various national marketing schemes and pricing policies followed by the government agencies and marketing boards which operate in the coffee-producing countries. The structural features of the processing sector are also briefly noted.

In the fourth chapter the argument that the structural features of the world market for unprocessed coffee conform to that of a seller's oligopoly for a differentiated product is further developed and the market conduct characteristics of the major coffee-producing and exporting countries are examined. In analyzing these market conduct characteristics, major emphasis is placed on the effects of the domestic

and external pricing and stock policies of the government and the statutory coffee authority of the world's largest coffee producer—Brazil. In Brazil, as in many other coffee-producing countries, market interventions have at times divorced prices paid to domestic coffee producers from the trend in world market prices. Geer evaluates the impact of these interventions on Brazil's coffee output for the period from 1949 to 1964 by means of a somewhat labored qualitative analysis involving comparison of trends in coffee acreage and output with prices of coffee and of competing crops in the two major coffee-producing states of that country. This analysis leads Geer to the conclusion that the accumulation of major stocks of Brazilian coffee over the period from 1954 to 1964 was the direct effect of the domestic policies of that country.

Effects of the Brazilian export price policy on the world coffee market are then examined and compared with the pricing and stock policies of the other major exporting countries. Geer concludes that these policies have been the major source of year-to-year fluctuations in coffee prices. A brief analysis of the New York Coffee Exchange leads to the conclusion that the thinness of this market is another factor contributing to fluctuations in world coffee prices.

The final chapter provides an evaluation of the International Coffee Agreement in terms of whether the provisions of this agreement are such as to provide for a situation of relative price stability and for long-run equilibrium in the world coffee industry. The analysis of the latter feature is not particularly convincing. Geer argues that, given the structure of the world coffee industry, the international commodity agreement approach is the only possible "second best" solution to achieving long-run equilibrium. Regarding the reduction of price fluctuations, the argument is made that the provisions of the agreement are such as to prevent price warfare amongst the oligopolistic sellers but are sufficient to prevent only indirectly price instability that might arise from such causes as market imperfections on the New York Coffee Exchange or from speculative activities of any oligopsonist purchasers.

A lengthy appendix which comprises more than a third of this book presents the full texts of the International Coffee Agreements of 1962 and 1968.

The general question of price instability in the world coffee market, the causes of this instability, and the impact of the International Coffee Agreement as a price-stabilizing mechanism are the central themes of this book. The study is based upon the assumption that world coffee prices exhibit excessive instability and that the degree of this instability is untenable because of the economic importance of this export commodity to the coffee-producing nations. The argument that export price instability is the major cause of unstable export receipts, which in turn have major adverse effects on the growth of the

less-developed primary produce-exporting nations (because of the disruptive effects of uncertainty on the formulation and execution of development plans and because of the adverse impacts of multiplier effects on investment, savings, and income), is a conventionally accepted thesis. There is, however, empirical evidence available which does not fully support this conventional thesis [1]. Geer's analysis of price instability would have been considerably strengthened by an evaluation of whether, and to what extent, the economies of the coffee-producing countries have been affected by export price instability.

In summary, the book does provide a comprehensive description of the national production and pricing policies followed by the world's major coffee producers until the mid-1960's. The analytic treatment of price instability is, however, disappointing. The book is marred in places by a rather tortuous method of expression and by fairly frequent typographical errors.

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Reference

- [1] MACBEAN, ALASDAIR I., *Export Instability and Economic Development*, London, George Allen & Unwin, Ltd., 1966.
- Grogan, F. O., ed., *International Trade in Temperature Zone Products*, Edinburgh, Oliver and Boyd, 1972, xiv + 313 pp. (\$6.60)
- Evans, John W., *The Kennedy Round in American Trade Policy: The Twilight of the GATT?*, Cambridge, Harvard University Press, 1971, xiii + 383 pp. (\$13.95)

These two highly useful books lead to the same general question: What can be expected in future international trade policy negotiations? But because the premises and scope of inquiry differ, they leave quite different impressions concerning future problems and prospects. Grogan's book concentrates on agriculture and the interaction between domestic agricultural policies and international trade policy. Evans, on the other hand, focuses on the GATT as an institution and its activities, especially the Kennedy Round.

Grogan includes three scene-setting chapters which: (1) examine the nature of the conflict between agricultural and trade policies, (2) review and assess past agricultural trade negotiations and the reasons for their failure, and (3) provide a summary of existing national agricultural policies in major free world industrial countries. The second part of the book consists of four commodity chapters including: (1) "Cereals" by P. W. H. Weightman, (2) "Sugar" by F. Grogan, (3) "Wheat" by R. Gallenti, and (4) "Dairy Products" by A. G. Tansey. Two final chapters include a summary and an assessment of current issues with some considerations for the future.

A major premise of this book is that the past will be repeated in the future. For developing countries the author foresees a continuation of the present tendency for food production to outpace effective demand. Further, he foresees increased emergence of surpluses as a side effect of successful policies for self-sufficiency in less-developed countries. The ability to cope satisfactorily with surpluses will depend on the growth of effective demand in less-developed countries and on the degree of international cooperation in trade matters, including the willingness of developed countries to use surpluses as aid to less-developed countries.

Grogan calls for serious appraisal of the economic relationship between agriculture and the rest of the economy within individual countries to elucidate the operation of agricultural markets for both the product and the goods and services it buys. A number of considerations indicates that the time may now be opportune for various countries to reappraise their agricultural policies and reformulate objectives and priorities. The reasons for this optimism (which may be somewhat premature) include: (1) the fact that agriculture in developed countries is becoming a relatively minor component of the total economy; (2) many agricultural policies were originally devised as defense measures against economic depression, and because of effective general economic policies severely depressed periods are not likely to reoccur; (3) the trend toward concentration and vertical integration is changing the character of agriculture; (4) major unfavorable shifts in agriculture's terms of trade in the future seem unlikely; and (5) existing policies entail major costs to consumers and taxpayers.

Evans' book clearly demonstrates his detailed acquaintance with the operation of GATT, particularly the Kennedy Round. Part I deals with issues and is cast in broader perspective than an analysis of the Kennedy Round as such. His first chapter is a short history of tariff negotiations from 1934 to 1962. The five succeeding chapters deal with general issues including reciprocity, nondiscrimination, the problems of agriculture, nontariff barriers, and trade of less-developed countries. Following this, Evans deals specifically with the problems and processes of tariff negotiations. In three sections he considers the climate for negotiations (relations between the EEC and the U. S. prior to the Kennedy Round), the process of sparring over the rules of negotiation, and the struggle for reciprocity (the negotiating process). A final section of the book assesses changes in the climate for trade policy since 1967 and possible future developments.

The Kennedy Round clearly was a difficult negotiation. The United States had forcefully expressed its concern over EEC policy in the Dillon Round and was placing major emphasis on the restrictive effects of the common agricultural policy. No previous negotiation had been based on across-the-board linear

reduction, and setting the rules for negotiation required a large proportion of the time committed to the total process. The substantive negotiation involved a continuous search for reciprocity within the constraints of the list of exceptions that had been tabled by most of the major participants.

His general conclusion is that the Kennedy Round was relatively successful but that the outlook for future progress within the GATT format and philosophy may not be bright. The foundation of GATT philosophy is nondiscrimination and, of almost equal importance, a prohibition against nontariff trade restriction. Increasingly, trade policy is being dominated by discrimination through customs unions, preference areas and administrative and quantitative restrictions. In particular, existing pressure within the U. S. Congress supports quantitative restrictions, and in some cases these are being proposed to provide the President with the bargaining power to extract "voluntary agreements" from exporting countries. "The omen for the 1970s, thus, is for still further departure from the original GATT model of world trade" (p. 323). The most devastating conclusion the author comes to, however, in terms of future trade policies is the following: "Of the actors on the stage of world trade in the 1970s only two—the United States and the EEC—come close to having the economic power required to lead the world toward the revival of a genuine multilateral trading system. Of these, the EEC, whether or not enlarged, is unlikely to have the necessary incentive for a long time to come, and the United States is certain to have neither the will nor the power until it has conquered the causes of inflation and domestic strife" (p. 327).

Of the two authors, Grogan is more venturesome in providing suggested requirements for future progress in international policy. While he has no new formula, he does build on the lessons of the Kennedy Round in examining the possibilities for future progress in the areas in which agricultural negotiations were concerned, namely, achieving greater compatibility in national and international policy to bring about more orderly demand/supply and price relations in international trade. The strength of Evans' book lies more in his insights into the processes involved in trade negotiations. He includes a bonus in his explanation of the political processes involved in preparation for the Kennedy Round, both by the United States and the EEC. His discussions of the campaign by the Kennedy Administration for new trade legislation and the political logic involved in devising the content of the Trade Expansion Act of 1962 were particularly interesting (pp. 139–159).

Both volumes will be very useful to anyone interested in international commercial policy. Despite the fact that the same question seems to have guided each author, there is virtually no overlap in the material covered. Rather, the books complement one another. Grogan's analysis, though it concentrates on

conditions and relationships in agriculture, develops a linkage with problems of international negotiation. Evans, on the other hand, relates his analysis of the negotiating process to major problem areas encountered in negotiations, the most difficult of which was agriculture in the Kennedy Round.

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Padberg, Daniel I., *Today's Food Broker: Vital Link in the Distribution Cycle*, New York, Chain Store Publishing Corporation, 1971, xii + 200 pp. (\$10.00)

If one approaches this book with the expectation of encountering a good economic analysis or an insightful institutional analysis, he will be disappointed. This book is one of the all too familiar public relations jobs done under the auspices of trade associations. We must point out that it does not pretend to be anything else. This is best described and established by repeating here the first paragraph of the preface of the book:

The purpose of this book is to organize facts about the food broker industry, its history, its trade association, and its setting in the food industry. It is designed to show how the goals of the food broker are compatible with those of the food industry he serves and of society in general. It is dedicated to promoting a better understanding of the industry and of how it works. Such an understanding can also aid the performance of food brokers, and, thereby, enhance their image and their relationship with the rest of the food industry and with the public at large.

If one keeps in mind that this is not a scholarly work, one can profitably use the work for a description of the services performed by food brokers and the institutions they serve. The effort is almost totally non-quantitative, being a qualitative description of the types of activities engaged in by the food broker.

This book is far better written than most books of this type. On the other hand, the author delivers himself of many opinions not supported by the literature or by evidence presented in the book.

Since virtually nothing else is in print on the role played by the modern food broker, this is probably a book that will be needed in the library of anyone doing work on marketing institutions or analysis of marketing systems. It does supply some information which could be a part of the inputs to a serious analytical effort. It would also serve as a starting point to guide one in initiating an empirical study.

BOB R. HOLDREN
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Takayama, Takashi, and George G. Judge, *Spatial and Temporal Prices and Allocation Mod-*

els, Amsterdam, North-Holland Publishing Company, 1971, xx + 528 pp. (\$23.50)

Students of interregional and international trade have been interested for a long time in "models that may be employed in analyzing pricing and allocation problems" in spatial systems. This book provides such models and in great abundance. The basic approach adopted by the authors is to establish a formal equivalence between trade equilibria and extremum problems and then to employ programming techniques as the main instruments for solving equilibrium prices and quantities. This approach has two obvious advantages. First, establishing the equivalence relation between competitive equilibria and extremum problems endows the theory with considerable economy and simplicity—all that one has to know is the function to be maximized, or minimized, and the relevant restrictions. The second advantage is on a more practical level. Since computer libraries usually include an assortment of programming routines, the computational problem involved in obtaining equilibrium solutions is easily handled by translating the equilibrium problem into a programming one. The fundamental question is related, however, to the nature and validity of the underlying equivalence.

Since, under certain conditions, a competitive equilibrium implies Pareto optimality, a good point of departure is to show that corresponding to any given distribution of initial endowments one can find a "Paretian" social welfare function whose maximization yields the competitive equilibrium. Aided with the Kuhn-Tucker equivalence theorem and Brouwer and Kakutani "fixed point" theorems, the authors manage to sketch out the desired proofs for general competitive spaceless and spatial equilibria (Part V).

However, an operational model must be formulated in terms of observable behavioral relations and the social welfare function is, in this respect, a useless concept. Is it possible to replace the social welfare function by another objective function that will do the trick? The answer is sometimes in the affirmative we are told by the authors. That is, if the aggregate regional demand and supply functions satisfy certain "integrability conditions," then a "net quasi-welfare function" can be constructed and used as the objective function in the equivalent programming problem. (This function consists of the "area under the demand functions" minus the area under the supply functions minus transportation costs.) Essentially, this amounts to saying that the aggregate regional demand behavior could be derived from a regional "community indifference map." The approach was first employed by Samuelson for the single commodity case where no difficulties of the kind arise. The authors have extended it to the more problematic multi-commodity situations. Recognizing the restrictive nature of the integrability conditions, the authors propose an alternative formulation. Here, a net revenue function, consisting of the total revenue,

calculated at the demand prices minus the value of goods supplied, calculated at the supply prices (not necessarily equal to total production cost as the authors seem to imply) minus the transportation costs is employed as the objective function. This function is maximized subject to competitive behavior by producers, consumers, and traders (i.e., exporters and importers). In view of the central importance of the integrability conditions in determining the suitability of the various models, it is deplorable that the authors refrain from indicating the circumstances under which these conditions are satisfied.

Many spatial models are presented in the book. Beginning with a general exposition of the equilibrium conditions and their relation to extremum problems (Part I), the authors proceed in a detailed and systematic manner to develop a variety of spatial price and allocation models. First, the classical transportation problem where demand and supply quantities are given is analyzed (Part II). This assumption is later relaxed, and all quantities are determined endogenously for given regional demand and supply functions (Parts III and IV). The analysis of the single commodity case is extended to include multi-product formulations. Models of trade equilibria are specified and interpreted in terms of price and quantity formulations. These are related to the primal and dual formulations of the corresponding programming problems.

The usefulness of the general approach is illustrated by applying it to the analysis of trade policy (tariff, import quotas) and various forms of monopolistic behavior.

In some general sense temporal and spatial economic systems are similarly structured. Storage activities may be regarded as transfers over the time, rather than space, dimension. This resemblance leads Takayama and Judge to apply their general approach in formulating intertemporal and combined intertemporal-spatial models, a very useful extension.

No doubt the programming approach propounded by Takayama and Judge has a rather wide spectrum of applications. Nevertheless, not all operational models are of the "programming" variety. Thus, "Tramel-Seale's reactive programming method" (pp. 493-495) is in effect a market-simulating procedure, and only in special cases is it identifiable with "Hildreth's gradient method."

The book is well organized and comprehensive. It is not clear, however, what audience the authors had in mind. Those interested in empirical applications will find too much rigorous treatment of theoretical issues, while the theoretically-oriented readers will have no use for the detailed computational procedures and numerical illustrations. Also, the attempt to present a wide collection of models has certainly gone too far and there is a feeling of repetition. After all, the beauty of the authors' approach is in its unity, not diversity.

PINEHAS ZUSMAN

The Hebrew University of Jerusalem

Books Received

- Avramovic, Dragoslav, coordinating author, *Economic Growth of Colombia: Problems and Prospects*, Baltimore, The Johns Hopkins University Press for the International Bank for Reconstruction and Development, 1972, xx + 509 pp. \$15.00.
- Beckford, George L., *Persistent Poverty*, New York, Oxford University Press, 1972, xxvii + 303 pp. \$2.95. Paper.
- Bloom, Gordon F., *Productivity in the Food Industry: Problems and Potential*, Cambridge, The M.I.T. Press, 1972, xiii + 314 pp. \$10.00.
- Bordeaux, A. Frank, Jr., and Russell H. Brannon, eds., *Social and Economic Issues Confronting the Tobacco Industry in the Seventies*, Lexington, College of Agriculture and Center for Developmental Change, University of Kentucky, 1972, xv + 332 pp. Price unknown. Paper.
- Campbell, Lord of Eskan, Anthony Kershaw, Gerhard Schiffler, Tom Soper, Christopher Trapman, Charles van der Vaeren, and David Wall, *Britain, the EEC and the Third World*, New York, Praeger Publishers, 1972, ii + 95 pp. \$7.50.
- Dasgupta, Sipra, *Agriculture: Producer's Rationality and Technical Change*, New York, Asia Publishing House, 1972, xi + 184 pp. \$6.25.
- Drilon, J. D., Jr., ed., *Agribusiness Management Resource Materials, Vol. II: Agribusiness Asian Case Studies, Part I*, Tokyo, Asian Productivity Organization, 1971, xiv + 304 pp. Price unknown. Paper.
- Drilon, J. D., Jr., ed., *Agribusiness Management Resource Materials, Vol. II: Agribusiness Asian Case Studies, Part II*, Tokyo, Asian Productivity Organization, 1971, v + 444 pp. Price unknown. Paper.
- Fuchs, Victor R., ed., *Policy Issues and Research Opportunities in Industrial Organization*, New York, National Bureau of Economic Research, 1972, xvii + 73 pp. \$1.50.
- Gordon, Leland J., and Stewart M. Lee, *Economics for Consumers*, 6th ed., New York, Van Nostrand Reinhold Company, 1972, x + 719 pp. \$10.95.
- Gregory, G. Robinson, *Forest Resource Economics*, New York, The Ronald Press, 1972, viii + 548 pp. \$12.50.
- Gunn, Clare A., *Vacationscape: Designing Tourist Regions*, Austin, Bureau of Business Research, The University of Texas, 1972, ix + 238 pp. \$8.00. Paper.
- Hancock, W. K., *Discovering Monaro: A Study of Man's Impact on his Environment*, Cambridge, Cambridge University Press, 1972, xii + 209 pp. \$12.50.
- Isard, Walter, *Location and Space-Economy: A General Theory Relating to Industrial Location, Market Areas, Land Use, Trade, and Urban Structure*, Cambridge, The M.I.T. Press, 1956, xix + 350 pp. \$2.95. Paper.
- Johansen, Leif, *Production Functions: An Integration of Micro and Macro, Short Run and Long Run Aspects*, Amsterdam, North-Holland Publishing Company, 1972, ix + 274 pp. \$19.00.
- Kay, David A., and Eugene B. Skolnikoff, eds., *World Eco-Crisis: International Organizations in Response*, Madison, The University of Wisconsin Press, 1972, viii + 324 pp. \$2.50. Paper.
- Khan, Taufiq M., ed., *Studies on National Income and Its Distribution, Readings in Development Economics*, No. 5, Karachi, The Pakistan Institute of Development Economics, 1970, xii + 191 pp. \$5.00. Paper.
- Klise, Eugene S., *Money and Banking*, 5th ed., Cincinnati, South-Western Publishing Co., 1972, viii + 856 pp. Price unknown.
- Knox, Francis, *The Common Market and World Agriculture: Trade Patterns in Temperate-Zone Foodstuffs*, New York, Praeger Publishers, 1972, xii + 138 pp. \$12.50.
- Kornai, János, *Rush Versus Harmonic Growth*, Amsterdam, North-Holland Publishing Company, 1972, x + 154 pp. \$8.50. Paper.
- Kuznets, Simon, *Quantitative Economic Research: Trends and Problems*, New York, National Bureau of Economic Research, 1972, xxii + 93 pp. Price unknown.
- Matz, Samuel A., *Bakery Technology and Engineering*, 2nd ed., Westport, The AVI Publishing Company, Inc., 1972, x + 598 pp. \$29.00.
- McIlroy, R. J., *An Introduction to Tropical Grass-*

- land Husbandry*, 2nd ed., New York, Oxford University Press, 1972, ix + 160 pp. \$6.00. Paper.
- Meadows, Donella H., Dennis L. Meadows, Jorgen Randers, and William W. Behrens III, *The Limits to Growth*, New York, Universe Books, 1972, 205 pp. \$2.75. Paper.
- Merowitz, Leonard, and Stephen H. Sosnick, *The Budget's New Clothes: A Critique of Planning-Programming-Budgeting and Benefit-Cost Analysis*, Chicago, Markham Publishing Company, 1971, xi + 318 pp. \$10.95.
- Merk, Frederick, *Economic History of Wisconsin During The Civil War Decade*, 2nd ed., Madison, The State Historical Society of Wisconsin, 1971, 414 pp. \$10.00.
- Mishan, E. J., *Cost-Benefit Analysis: An Introduction*, New York, Praeger Publishers, Inc., 1971, viii + 364 pp. \$12.50.
- Mortenson, W. P., and R. A. Luening, *The Farm Management Handbook*, 5th ed., Danville, The Interstate Printers & Publishers, Inc., 1972, xiv + 488 pp. \$8.00.
- Nelson, Lowry, *Cuba: The Measure of a Revolution*, Minneapolis, University of Minnesota Press, 1972, xiii + 242 pp. \$10.00.
- Nordhaus, William, James Tobin, and others, *Economic Growth*, New York, National Bureau of Economic Research, 1972, xvii + 92 pp. \$1.50.
- Northrup, Herbert R., Richard L. Rowan, Darold T. Barnum, and John C. Howard, *Negro Employment in Southern Industry: A Study of Racial Policies in Five Industries*, Vol. IV, *Studies of Negro Employment*, Philadelphia, University of Pennsylvania Press, 1970, xiii + 583 pp. \$13.50.
- Oommen, M. A., *Land Reforms and Socio-economic Change In Kerala*, Madras, The Christian Literature Society, 1971, viii + 106 pp. Rs. 5. Paper.
- Papandreou, Andreas G., *Paternalistic Capitalism*, Minneapolis, The University of Minnesota Press, 1972, ix + 190 pp. \$7.50.
- Ramsay, William, and Claude Anderson, *Managing the Environment: An Economic Primer*, New York, Basic Books, Inc., 1972, xvi + 302 pp. \$7.50.
- Rogers, George B., and Leonard A. Voss, eds., *Readings on Egg Pricing*, Columbia, College of Agriculture, University of Missouri, 1971, 271 pp. Price unknown. Paper.
- Roy, Ewell Paul, *Contract Farming and Economic Integration*, 2nd ed., Danville, The Interstate Printers & Publishers, Inc., 1972, ix + 661 pp. \$9.25. Paper.
- Ryall, A. Lloyd, and Werner J. Lipton, *Handling, Transportation, and Storage of Fruits and Vegetables*, Vol. I, *Vegetables and Melons*, Westport, The AVI Publishing Company, Inc., 1972, viii + 473 pp. Price unknown.
- Schultz, Theodore W., *Investment in Human Capital*, New York, The Free Press, 1971, xii + 272 pp. \$8.75.
- Schultz, Theodore W., and others, *Human Resources*, New York, National Bureau of Economic Research, 1972, xviii + 97 pp. \$1.50.
- Shoup, Carl S., and others, *Public Expenditure and Taxation*, New York, National Bureau of Economic Research, 1972, xvii + 74 pp. \$1.50.
- Singer, Neil M., *Public Microeconomics*, Boston, Little, Brown and Company, 1972, xvii + 329 pp. \$8.95.
- Smith, Allan K., and Sidney J. Circle, eds., *Soybeans: Chemistry and Technology*, Vol. 1, *Proteins*, Westport, The AVI Publishing Company, Inc., 1972, xi + 470 pp. \$23.00.
- Stelzer, Irwin M., and Howard P. Kitt, *Selected Antitrust Cases: Landmark Decisions*, 4th ed., Homewood, Richard D. Irwin, Inc., 1972, xi + 425 pp. \$5.95. Paper.
- Stojkovic, George, *Market Models for Swedish Agriculture*, Uppsala, Almqvist & Wiksells Boktryckeri AB, 1971, 83 pp. Price unknown. Paper.
- Taylor, William B., *Landlord and Peasant in Colonial Oaxaca*, Stanford, Stanford University Press, 1972, xv + 287 pp. \$10.00.
- Tullock, Gordon, *The Logic of the Law*, New York, Basic Books, Inc., 1971, x + 278 pp. \$7.95.
- Vernon, John M., *Market Structure and Industrial Performance: A Review of Statistical Findings*, Boston, Allyn and Bacon, Inc., 1972, xiii + 140 pp. Price unknown. Paper.
- Ward, Benjamin, *What's Wrong with Economics?*, New York, Basic Books, Inc., 1972, x + 273 pp. \$6.95.
- Webber, Michael J., *Impact of Uncertainty on Location*, Cambridge, The M.I.T. Press, 1972, xviii + 310 pp. \$12.95.
- Whitcomb, David K., *Externalities and Welfare*, New York, Columbia University Press, 1972, x + 158 pp. \$8.00.
- White, Gilbert F., David J. Brandley, and Anne U. White, *Drawers of Water: Domestic Water Use in East Africa*, Chicago, The University of Chicago Press, 1972, xii + 306 pp. \$14.00.
- Zwick, David, and Marcy Benstock, eds., *Water Wasteland: Ralph Nader's Study Group Report on Water Pollution*, New York, Grossman Publishers, Inc., 1971, xvii + 494 pp. \$7.95.

Announcements

**WINTER MEETING
AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION
WITH THE
ALLIED SOCIAL SCIENCE ASSOCIATIONS**

**December 28-30, 1972
Toronto, Canada**

**The Validity and Verification of Complex
System Models**

(Joint session with the Econometric Society)
December 28, 1972
2:30 P.M.

Chairman: SAUL H. HYMANS, Department of Economics, University of Michigan

Paper: "Is Verification Possible?"

HAROLD T. SHAPIRO, Department of Economics, University of Michigan

Paper: "Implications to and from Economic Theory to Models of Complex Systems"

GARY FROMM, Department of Economics, American University

Discussants: to be announced

Trade Liberalization in Agricultural Products

(Joint session with the American Economic Association)

December 29, 1972
8:30 A.M.

Paper: "Future Directions for U. S. Trade"

C. FRED BERGSTEN, senior fellow, the Brookings Institution

Discussant: DALE HATHAWAY, chairman, Department of Agricultural Economics, Michigan State University

Paper: "Prospects for Freer Agricultural Trade"

JOHN A. SCHNITTKER, Schnittker Associates, Washington, D. C.

Discussant: Pierre Malve, counselor for trade affairs, European Communities

Paper: "The Impact of Freer Trade on North American Agriculture"

D. GALE JOHNSON, chairman, Department of Economics, University of Chicago.

Discussant: G. I. TRANT, Director-General, Eco-

nomics Branch, Canada Department of Agriculture.

Financing Agriculture and Rural Development

(Joint session with the American Finance Association)

December 29, 1972
2:30 P.M.

Chairman: GOVERNOR ANDREW F. BRIMMER, Federal Reserve Board, Washington, D. C.

Paper: "Promoting Rural Development: Alternative Capital Subsidy Programs"

HARRISON WEHNER AND BARRY ROGSTAD, SYSTAN, INC., Washington, D. C.

Paper: "Financing Agriculture: Demand for and Supply of Farm Capital and Credit"

EMANUEL MELICHAR, senior economist, Federal Reserve Board

Discussants: JOHN HOPKINS, Texas A&M University; WILLIAM MOTES, Economic Research Service; and CHESTER BAKER, University of Illinois.

**NOMINATING COMMITTEE
FOR 1973-1974 AAEA OFFICERS**

The following persons have been appointed by AAEA President Emery N. Castle to serve on a committee to nominate persons to fill vacancies in the offices of the Association for the year beginning August 1973:

Vernon W. Ruttan, Chairman

O. J. Scoville

Gene L. Swackhammer

John O. Gerald

Wesley D. Seitz

Fred Smith

J. Martin Redfern

William Joseph Lanham.

Any member of the Association is eligible and is invited to submit suggestions for nominees to the chairman, Vernon W. Ruttan, or to other members of the committee. Dr. Ruttan's address is the Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minnesota 55101.

NEW JOURNAL

Jerusalem Academic Press announces the publication of a new economics journal, the *Israel Quarterly of Economics*. Most of the articles in the *Quarterly* are translated from material which appeared in the *Riv'on Le'Kalkalah*, a Hebrew language quarterly published by Am Oved Publishers, Tel Aviv.

Editor of the English edition is Aryeh Greenfield. Overseas subscriptions are \$18 annually. Air mail and advertising rates may be obtained by writing Jerusalem Academic Press, P.O.B. 2390, Jerusalem, Israel.

THE EDWARD M. RYAN PRIZE

The Edward M. Ryan Prize has been established to encourage and promote applied research to aid in the solution of existing problems of malnutrition in low-income countries.

The \$10,000 prize has been established through a grant to the James and Rachel Levinson Foundation of Pittsburgh which will administer it.

The prize will be awarded to the program completed in 1972 or 1973 which best meets the following criteria: (1) Importance of the problem being address; (2) Quality of the work in terms of methodology and execution; (3) Degree to which the research is directed at problem solving; and (4) Applicability of the results to the problem.

Given the multidisciplinary nature of the subject, operationally-oriented research projects in a wide range of disciplines or combinations of disciplines can be considered. They must, however, relate specifically to the solution of malnutrition problems in low-income countries and have direct policy application. Actual pilot or demonstration programs which have served to increase knowledge on the efficacy of particular interventions are also eligible.

Applications containing reports of research completed in 1972 or 1973 must be received by Oct. 1, 1973. Announcement of the selection will be made about Dec. 1, 1973.

For application forms write to: Dr. F. James Levinson, chairman, The Edward M. Ryan Prize Committee, The James and Rachel Levinson Foundation, P.O. Box 1617, Pittsburgh, Pennsylvania 15230.

FOREIGN AREA FELLOWSHIP PROGRAM ANNUAL COMPETITION

The Foreign Area Fellowship Program, which provides support to advanced doctoral candidates at U. S. and Canadian universities for dissertation research in many parts of the world, announces its annual fellowship competition for the 1973-74 academic year.

The program supports dissertation research in Africa and the Near East, East, South and Southeast Asia, Western Europe, and Latin America and the Caribbean. The Latin American-Caribbean program also offers post-doctoral individual and collaborative research grants, professional internships, and other appointments.

Applications are accepted for doctoral dissertation research in the social sciences, the humanities, and the professions, with preference given to topics of contemporary relevance concerned with cultural economic, political, social, or scientific aspects of development.

While exact closing dates have not been set, all applications for dissertation research will be due by mid-November.

There are no citizenship limitations for research in Asia. However, since requirements for other area programs vary, applicants should contact the program directly for particulars.

Announcements and fellowship applications are available by writing to the Foreign Area Fellowship Program, 110 East 59th Street, New York, New York 10017.

1972 AAEA AWARDS PROGRAM

AAEA DISTINGUISHED EXTENSION PROGRAM AWARD

To encourage the development of excellence in extension economics work, the American Agricultural Economics Association will offer one award in 1973 known as the Distinguished Extension Program Award. Nominations for the award may be made by any member(s) of the AAEA and selection will be made from among those nominated. An individual may be nominated or two or more individuals may be nominated jointly. The purpose of the award is to recognize an outstanding program achievement. The award will be made to the individual or group primarily responsible for conceptualizing, developing, and conducting the program.

Each nomination must be made by separate letter to the Extension Award Selection Committee by Feb. 15, 1973, accompanied by *four copies* of documentary evidence of the achievement of the person or persons nominated. The evidence should include an adequate presentation of the following points, in this order: (1) program title; (2) the problem addressed by the program; (3) clientele served; (4) objective(s) of the program; (5) procedures used, including analytical tools, techniques, and educational methods and materials; (6) accomplishments, in terms of clientele response and/or establishment of the utility of an extension technique; and (7) name(s) and title(s) of the individual(s) primarily responsible for the program.

The program must have been active within one year of nomination, and its subject matter content must be principally in the field of economics.

Each nomination will be evaluated on the quality

of the program that supports the nomination, using the documentary evidence submitted with the nomination as the sole basis for making this evaluation. Equal weight will be given each of the following five characteristics of the program:

1. Originality in selection of the problem and the application of economic principles, tools of analysis, and extension techniques to its solution.
2. Its effectiveness as a catalyst to other extension economists in embarking on new programs or in applying new concepts to existing programs.
3. Its contribution to greater proficiency of extension personnel in economics programs.
4. Its effectiveness in bringing about a significant change in behavior and/or understanding of the clientele.
5. Originality in recognizing educational opportunities which lend themselves to use in an extension economics program.

Material should be sent to the subcommittee chairman, **Jean B. Wyckoff, Department of Agricultural Economics, 240 Extension Hall, Oregon State University, Corvallis, Oregon 97331.**

AAEA EXTENSION PUBLICATION AWARD

To encourage and recognize excellence in extension economics work, the AAEA will offer an award in 1973 known as the Extension Publication Award.

Eligibility for the Award

This award is open to any professional agricultural economist; however, the nomination must be made by a member of the AAEA. Any type of published material shall be eligible for the award.

Nominations for the Award

Each nomination for the Extension Publication Award must be signed by the nominator and include the following:

1. the name(s) of the person(s) nominated;
2. a concise statement of the problem about which the publication is written;
3. a statement revealing the direct applicability of the publication to an ongoing extension program;
4. identification of the audience for whom the publication was intended; and
5. copies of the publication.

Criteria for Judging Nominations

1. Clarity of the problem statement about which the publication is written.
2. Completeness and conciseness of the analysis in the publication.
3. Adaptability of the publication to the audience for whom it was intended.
4. Contribution to the body of knowledge available for direct use in extension economics programs.
5. Relevance to a current problem.
6. Timeliness and effectiveness in its intended purpose.

Eight copies of the nomination and supporting materials must be in the hands of the chairman of the selection committee by *Feb. 15, 1973*. Nominations should be sent to **Jean B. Wyckoff, Department of Agricultural Economics, 240 Extension Hall, Oregon State University, Corvallis, Oregon 97331.**

AAEA DISTINGUISHED UNDERGRADUATE TEACHING AWARDS

To recognize and encourage meritorious performance in undergraduate teaching in agricultural economics, two awards are provided for presentation by the AAEA upon recommendation of the selection committee. Nominations for these awards may be made by an individual, a group of colleagues, or a department by the submission of supporting materials according to the rules for this program. Renominations are invited if the materials are brought up to date and resubmitted.

Eligibility for Nomination

Each nominee must

1. be actively engaged in teaching at a professional level during the school year in which the nomination is filed with the selection committee;
2. have demonstrated outstanding ability as an undergraduate teacher of agricultural economics.

Basis of Selection

Each award will be made on the basis of

1. the nominee's ability to motivate and stimulate students;
2. the impression he has made upon his students by the mastery of his subject, his technique, his vision, and his attitudes;
3. evidence of his interest in the improvement of teaching through publication and participation in professional meetings directed toward improved teaching;
4. contribution to undergraduate education outside the classroom through counseling, student placement, advice to the departmental student club, and similar activities;
5. service to the undergraduate program of the educational institution through extracurricular activities other than those included above, such as membership on college committees, teaching improvement efforts, and faculty leadership roles.

Materials to be Supplied by the Nominator

1. A nomination with supporting materials may be submitted by an individual, a group of colleagues, or a department. The committee chairman will provide the standard nominating form to department heads and chairmen. Others wishing to nominate may obtain forms from the committee chairman.
2. The selection committee for the Teacher Awards consists of six persons, either present or for-

mer undergraduate teachers, appointed for staggered terms, and will not include anyone nominated for the award. All members of the selection committee participate in the judging. The selection committee is empowered to recommend that no award be made if, in its judgment, none of the nominees is worthy of the award.

3. A nomination will be considered in either of two categories. The first category will include nominees who at the time of nomination have been engaged in undergraduate teaching for less than 10 years. The second category will include nominees who at the time of nomination have been engaged in undergraduate teaching for 10 or more years.

4. Nominations with supporting materials for the Teacher Awards should be sent by *Feb. 15, 1973*, directly to the chairman of the subcommittee, **John W. Goodwin, Department of Agricultural Economics, Oklahoma State University, Stillwater, Oklahoma 74074.**

AAEA AWARDS FOR RESEARCH IN AGRICULTURAL ECONOMICS

To recognize and encourage meritorious research in agricultural economics, 10 awards will be offered in 1973 by the AAEA.

Selection for the awards will be made from published research, doctoral theses, master's theses, and articles in the *American Journal of Agricultural Economics* under the procedures outlined below. No one may receive more than one award in any one year, or an award in the same category more than once every three years. No publication shall be eligible for an award if its substantive equivalent has received an award in any category in an earlier year. All materials submitted should be in English or accompanied by an English translation.

Awards for Published Research

1. Three awards are offered for outstanding research publications in agricultural economics. These may include bulletins, articles, pamphlets, and monographs but not textbooks.

2. Submissions are invited from areas such as farm management, marketing, prices, cooperation, finance, policy, theory, methodology, rural development, farm population, foreign agriculture, land and water economics conservation, regional adjustment, international trade, economic history, and state and local government that throw light on the agricultural economy. Entries will be judged as a group rather than in particular areas.

3. Selections will be made from published research bearing a publication date in 1972.

4. Eligible recipients must be under 41 years of age at the time of publication but may have older joint authors.

5. Any paper authored or coauthored by a member of this awards subcommittee will be ineligible.

6. No penalty for joint authorship will be imposed

unless one or more authors are over 41 years of age.

7. Each published report may receive only one award presented by the AAEA in 1973. Authors are discouraged from submitting reports of substantive equivalents in more than one category.

8. *Thirteen copies* of each publication should be submitted for consideration, unless expense to the individual is excessive.

9. The awards subcommittee for published research consists of 12 persons, in addition to the chairman, representing various fields. The members of the subcommittee will serve as voting judges, except the chairman, who will vote only in the event of a tie. The chairman of this subcommittee is **J. A. Seagraves, Department of Economics, North Carolina State University, Raleigh, North Carolina 27607.**

10. Publications should be sent directly to the chairman of this subcommittee before *Feb. 15, 1973.*

Awards for Doctoral Theses

1. Three \$100 awards will be available for theses prepared by candidates for the doctoral degree in any department engaged in training agricultural economists at the doctoral level.

2. An entry must be submitted by the head of the department where the thesis was presented in partial fulfillment of requirements for a degree. A department may submit one thesis for each 12 doctoral theses or fraction thereof presented in agricultural economics to a graduate school faculty in the year. In determining the number of eligible theses, departments should limit consideration to theses of candidates who will receive a degree in agricultural economics and to theses of candidates who have taken agricultural economics as a field of emphasis.

3. Selection will be made from theses approved in final form by the student's advisory committee during the calendar year 1973, provided the candidate has met all other formal requirements for the doctoral degree.

4. A published thesis may be entered in both the published research and thesis classes but will be eligible for only one award. Although a published thesis is acceptable, a copy of the thesis as submitted to the graduate faculty should be sent whenever possible.

5. *Three copies* of a thesis must be sent to the subcommittee chairman. All copies will be returned after they have been read by the judges.

6. The awards subcommittee on doctoral theses will consist of 12 persons, in addition to the chairman. All members of the subcommittee will serve as voting judges, except the chairman, who will vote only in the event of a tie. The chairman of this subcommittee is **Joseph C. Purcell, Department of Agricultural Economics, Georgia Agricultural Experiment Station, Experiment, Georgia 30212.**

7. Theses should be sent directly to the chairman of this subcommittee before *Feb. 15, 1973.*

Awards for Master's Theses

1. Three \$100 awards will be available for theses prepared by candidates for the master's degree in any department engaged in training agricultural economists at the master's degree level.

2. An entry must be submitted by the head of the department where the thesis was submitted in partial fulfillment of requirements for a degree. A department may submit one thesis for each 15 master's theses or fraction thereof presented to a graduate school faculty in the year. In determining the number of eligible theses, departments should limit consideration to theses of candidates who will receive a degree in agricultural economics and to theses of candidates who have taken agricultural economics as a field of emphasis. Departments are strongly encouraged to submit bound copies reproduced by a high quality process.

3. Selection will be made from theses approved in final form by the student's advisory committee during the calendar year 1973, provided the candidate has met all other formal requirements for the master's degree.

4. *Three copies* of a thesis must be sent to the subcommittee chairman. All copies will be returned after the committee has completed its work.

5. A published thesis may be entered in both the published research and thesis classes but will be eligi-

ble for only one award. Although a published thesis is acceptable, a copy of the thesis as submitted to the graduate faculty should be sent whenever possible.

6. The awards subcommittee for master's theses will consist of 12 persons in addition to the chairman. All members of this subcommittee will serve as voting judges, except the chairman, who will vote only in the event of a tie. The chairman of this subcommittee is **Robert W. Herdt, Department of Agricultural Economics, University of Illinois, Urbana, Illinois 61801.**

7. Theses should be sent directly to the chairman of this subcommittee before *Feb. 15, 1973.*

AWARD FOR OUTSTANDING ARTICLE IN THE *American Journal of Agricultural Economics*

The editorial staff and editorial council of the *American Journal of Agricultural Economics*, with the editor as chairman, will choose the most outstanding article in the 1972 volume of the *Journal*.

Announcement of the 1972 awards will be made at the 1973 annual meeting of the American Agricultural Economics Association. Names of the recipients of the 1972 awards will appear in the 1973 proceedings issue of the *American Journal of Agricultural Economics*.

News Notes

UNIVERSITY OF ARIZONA

APPOINTMENTS: Edwin H. Carpenter, assistant rural sociologist; William Hanekamp, research assistant; John L. Fischer, USAID chief of party and senior agricultural advisor in Turkey; Jimmie S. Hillman, to the Agricultural Board, National Research Council, National Academy of Sciences.

HONOR: JIMMYE S. HILLMAN, elected Senior Faculty Fellow of Jesus College, Oxford University.

LEAVE: Jimmie S. Hillman, to the Agricultural Economics Research Institute, Oxford University, England, to study trade problems in the Common Market.

UNIVERSITY OF CALIFORNIA, DAVIS

APPOINTMENTS: J. Herbert Snyder, formerly chairman of the Division of Environmental Studies, director of the Water Resources Center, University of California; Daryl E. Carlson, Ph.D. candidate, University of California at Berkeley, assistant professor; Oscar R. Burt, Montana State University, visiting professor of agricultural economics.

LEAVES: Gerald W. Dean, special leave of absence to participate in and initiate research in economics and agricultural economics and to assist in setting up graduate training in these fields at two principal universities in Santiago, Chile; Theodore P. Lianos, special leave of absence to participate in research and teaching at the Center of Planning and Economic Research at Athens, Greece; Gordon C. Rausser, special leave of absence to serve as visiting professor of economics at Northern Illinois University (fall quarter) and to participate in workshops on information theory, time series analysis, and the construction of empirical control models at the University of Chicago.

CLEMSON UNIVERSITY

APPOINTMENTS: Raleigh A. Jobes, formerly with Southern Illinois University, assistant professor; Bobby Hugh Robinson, formerly with FPED, ERS, USDA in Washington, D. C., associate professor.

COLORADO STATE UNIVERSITY

APPOINTMENTS: Robert R. Keller, formerly assistant professor and associate chairman of the Department of Economics, California State University, appointed assistant professor and assistant department chairman; George E. Radosevich, assistant professor of environmental law and economics, a joint appointment with the Department of Economics and the College of Business; Jerry Eckert, assistant professor and agricultural economist with the AID/Colorado State University field party in West Pakistan (two-year assignment).

RESIGNATIONS: S. K. Oakleaf, extension associate professor, to become assistant director of Community and Resource Development in Colorado for the Federal Extension Service, effective August 15, 1972; Quentin D. Banks, professor, to accept a Federal Extension position in agricultural marketing in the Colorado State Department of Agriculture, Denver, effective July 1, 1972.

RETURNS: William Spencer has returned from a two-year assignment as an extension specialist with the Agency for International Development office in Panama; Rex D. Rehnberg has returned to his position as professor after completion of a two-year assignment as an agricultural economist with the AID/University of Nebraska team in Colombia.

CORNELL UNIVERSITY

APPOINTMENT: Darrel L. Good, Ph.D. Michigan State, assistant professor.

LEAVE: Glenn W. Hedlund, six-months' sabbatical to the International Executive Service Corps, Brazil.

RESIGNATION: Sanford A. Belden, assistant professor, to the Springfield Farm Credit Banks.

RETIREMENT: Stanley W. Warren, after 40 years of service.

AWARD: Robert S. Smith was chosen the 1972 Professor of Merit by the seniors in the College of Agriculture and Life Sciences.

ECONOMIC RESEARCH SERVICE

(EDD, Economic Development Division; ESAD, Economic and Statistical Analysis Division; FDCC, Foreign Demand and Competition Division; FDD, Foreign Development Division; FPED, Farm Production and Economics Division; MED, Marketing Economics Division; NRED, Natural Resource Development Division.)

APPOINTMENTS: Frederick W. Crook, FDCC; David Dyer, ESAD; Roger Euler, FDCC; Patrick O'Brien, FDCC; Frank H. Osterhoudt, NRED; James R. Scullen, FDCC.

AWARDS: Rex F. Daly, director, ESAD, USDA Distinguished Service Award; Quentin M. West, administrator, ERS, USDA Distinguished Service Award for the Agricultural Mission to Turkey.

LEAVE: Carolee Santmyer, FDCC, for a two-year study.

REASSIGNMENTS: Philip T. Allen, to assistant field research coordinator, FPED; George Irwin, as head, Southern Field Group, FPED; Richard Kennedy, from USDA liaison at Virginia State University to FDCC; Charles Micheel, FPED-South Dakota to North Dakota; John Penson, FPED-Illinois to Washington, D. C.; John Putnam, NRED-Washington, D. C. to Michigan; James Vermeer, as assistant director, FPED; Valentine Zabijaka, to FDCC from EDD.

RESIGNATIONS: Harold Barnhill, FPED; A. B. Carr, FPED; James Gulley, FPED; Milton Holloway, NRED; Philip Luxenberger, NRED; Edward Micka, FPED; Bobby H. Robinson, FPED; John Subat, FPED; George Jennings, NRED; Fred Abel, EDD.

RETIREMENTS: Malcolm Clough, ESAD; Edmund Hamlin, FPED; William Frank Hughes, FPED; Hugh A. Johnson, NRED; Ronald Mighell, FPED; Harry Sitler, FPED; Paul Strickler, FPED; Max M. Tharp, NRED; Morris L. Weinberger, NRED.

UNIVERSITY OF FLORIDA

APPOINTMENT: Lester H. Myers, formerly with the Florida Citrus Commission, associate professor.

RETIREMENTS: Professors E. W. Cake and W. K. McPherson.

UNIVERSITY OF GEORGIA, GRIFFIN

APPOINTMENT: Mac Reese Holmes, Ph.D. Mississippi State, assistant professor.

RETIREMENT: Newton M. Penny.

UNIVERSITY OF IDAHO

RETURN: Roger Long, associate professor, has returned from a two-year leave with the Department

of Agricultural Economics, University of Alberta, Edmonton.

IOWA STATE UNIVERSITY

APPOINTMENT: Daniel S. Tilley, research associate.

HONOR: John F. Timmons, professor of economics, named the Charles F. Curtiss Distinguished Professor in Agriculture.

LEAVES: Erik Thorbecke, professor, during the 1972-73 academic year to accept an appointment with the International Labor Office of the United Nations to help direct the World Employment Program; Richard C. Maxon, associate professor, from Sept. 1, 1972, to Aug. 31, 1973, to serve as a Senior Visiting Lecturer in the Department of Economics, University of Ibadan, Ibadan, Nigeria, under sponsorship of the Rockefeller Foundation; Leo V. Mayer, associate professor, from Aug. 1, 1972, to July 31, 1973, to accept an appointment as senior staff economist with the President's Council of Economic Advisers, Washington, D. C.

RESIGNATIONS: Iftikhar Ahmed, postdoctoral associate, to accept an appointment as deputy chief economist in the Bangladesh Planning Commission; Larry D. Bedford, instructor, to accept a position with Armour and Co. in Nampa, Idaho.

UNIVERSITY OF KENTUCKY

APPOINTMENT: David Holland, Ph.D. Oklahoma State, assistant professor in rural development.

LOUISIANA STATE UNIVERSITY

APPOINTMENT: Martin D. Woodin, executive vice president, appointed President, Louisiana State University.

UNIVERSITY OF MAINE AT ORONO

APPOINTMENT: Edward S. Micka, associate professor and extension economist in marketing.

RETIREMENT: Frank D. Reed, extension economist in marketing, after 34 years of service. The Northeast Agricultural Economic Council at its recent annual meeting awarded the Distinguished Life Membership to Mr. Reed.

MICHIGAN STATE UNIVERSITY

HONOR: James T. Bonnen was presented the Distinguished Faculty Award by the university.

LEAVES: Dale Hathaway, for one year beginning Sept. 1, 1972, to work with the Ford Foundation in New York; G. E. Rossmiller, to Korea with the MSU Project through March 1973.

REASSIGNMENTS: James D. Shaffer has added extension responsibilities to his teaching and research duties; Lawrence Witt has added extension responsibilities in community development to

his teaching and research duties; **Leonard Kyle**, program leader, extension farm management.

RESIGNATION: **W. A. Tinsley**, to accept a position at Clemson University.

RETIREMENTS: **Karl T. Wright**, on July 1, after 43 years of service; **John Doneth**, on December 31, after 36 years of service.

UNIVERSITY OF MINNESOTA

APPOINTMENT: **Terry L. Roe**, assistant professor, has accepted an assignment in Tunisia on the University of Minnesota/Tunisia project, under a contract with UM and the Agency for International Development, Department of State.

HONOR: **E. Fred Koller**, professor, received the Horace T. Morse Award provided by the Standard Oil Foundation for outstanding contributions to undergraduate education.

RETURN: **Jerome W. Hammond**, associate professor, has returned from a two-year assignment in Tunisia (one year as party chief) for the Minnesota/Tunisia project.

MISSISSIPPI STATE UNIVERSITY

APPOINTMENT: **Fred H. Tyner**, formerly associate professor at the University of Florida, professor and economist in rural development.

UNIVERSITY OF MISSOURI

APPOINTMENTS: **Frederick D. DeLano**, M.S. Missouri, instructor in farm management; **Don LeVan**, M.S. Missouri, Platte County Area Farm Management Specialist UM Extension Division; **Harold Sterrett**, M.S. Missouri, Boonslick Area Farm Management Specialist, UM Extension Division.

NORTH CAROLINA STATE UNIVERSITY

APPOINTMENTS: **George D. Irwin**, professor and acting head, Southern Field Group, FPED, ERS, USDA; **Fred D. Sobering**, extension professor in charge of extension economics.

OKLAHOMA STATE UNIVERSITY

AWARD: **Alan R. Tubbs**, presented the Edwin G. Nourse Award by the American Institute of Cooperation for the outstanding Ph.D. dissertation on agricultural cooperation.

LEAVE: **Luther Tweeten**, to the Center for Research on Poverty and the Department of Agricultural Economics, University of Wisconsin, Sept. 1972 to July 1973.

PURDUE UNIVERSITY

APPOINTMENTS: **Ralph M. Brooks**, assistant professor in community development; **David C. Petritz**, assistant professor in farm management.

LEAVES: **William S. Farris**, Farmer Cooperative Service, USDA, one year; **Ronald D. Knutson**, Marketing and Consumer Services, USDA, continuation for one year; **Don Paarlberg**, director, Agricultural Economics, USDA, continuation for one year; **Lee F. Schrader**, Harvard University, in cooperation with the Farmer Cooperative Service, USDA.

HONOR: **J. Carroll Bottum**, Hillenbrand Professor, received an honorary Ph.D. degree from Purdue University.

RESIGNATION: **Thomas C. Kerr**, to the Canada Department of Agriculture, Ottawa.

RETIREMENT: **F. Van Smith**, after 38 years of service.

RETURNS: **William L. Miller**, associate professor, after one year with the Economic Research Service, Washington, D. C.; **Robert E. Schneidau**, professor, after one year with the Department of Agricultural Economics, Oregon State University.

SOUTH DAKOTA STATE UNIVERSITY

APPOINTMENTS: **Robert E. Olson**, associate professor in livestock marketing; **William E. Kamps**, assistant professor; **Shelby J. Smith**, assistant professor.

UNIVERSITY OF TENNESSEE

APPOINTMENTS: **T. J. Whatley**, Distinguished Professor and head of the Department, appointed assistant dean, Tennessee Agricultural Experiment Station; **M. L. Downen**, professor and leader, Agricultural Economics Extension Service, appointed assistant dean, Tennessee Agricultural Extension Service; **J. A. Martin**, professor, appointed head, Department of Agricultural Economics and Rural Sociology; **B. J. Hicks**, associate professor, appointed professor and leader, Agricultural Economics Extension Service; and **B. J. Deaton**, Ph.D. Wisconsin, appointed assistant professor.

UTAH STATE UNIVERSITY

APPOINTMENT: **Cris Lewis**.

RETURN: **N. Keith Roberts** has returned from a three-year assignment in Bolivia.

UNIVERSITY OF VERMONT

RESIGNATION: **Frederic O. Sargent** has resigned as chairman of the Department of Resource Economics. He will continue to direct the interdepartmental graduate program in regional planning.

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

APPOINTMENTS: **Robert B. Jensen**, formerly with the University of California-Davis, assistant pro-

fessor in production economics; **Leonard A. Shabman**, formerly with Cornell University, assistant professor in resource economics.

REASSIGNMENT: **Paul H. Hoepner**, to associate dean of the Graduate School.

RESIGNATION: **O. Richard Morris**, to the Canada Department of Agriculture, Ottawa.

RETIREMENT: **William L. ("Hoot") Gibson** retired as Professor Emeritus of Agricultural Economics, after 37 years of service.

WASHINGTON STATE UNIVERSITY

RETIREMENT: **Dr. Laszlo Valko** on June 30, 1972, after 21 years of service.

WEST VIRGINIA UNIVERSITY

APPOINTMENT: **Gerald V. Eagan**, Ph.D. Tennessee, extension specialist in agricultural economics and assistant professor.

UNIVERSITY OF WISCONSIN

APPOINTMENT: **Peter Dorner**, as chairman of the department, effective July 1, 1972.

RESIGNATION: **William B. Lord**, to accept a position with Resources for the Future in Mexico.

RETIREMENT: **Marvin A. Schaars**.

OTHER APPOINTMENTS:

Eliseu R. A. Alves, Ph.D. Purdue, Belo Horizonte, Brazil.

Michael M. Baumann, M.S. Missouri, farm mortgage loan officer and land appraiser, Connecticut Mutual Life Insurance Co., Fort Worth, Texas.

Lenny L. Benton, M.S. Arkansas, to the Market Development Department, Monsanto Chemicals, Inc.

Jacques Blas, Ph.D. Missouri, commodity specialist, FAO, Rome.

Gerald Campbell, assistant professor, University of Wisconsin.

Ralph W. Cummings, Jr., formerly agricultural economics advisor with the Harvard Advisory Group in Indonesia, to the Rockefeller Foundation, New York, as agricultural economist.

Brady J. Deaton, Ph.D. Wisconsin, assistant professor, Department of Economics, University of Tennessee, Knoxville.

H. Evan Drummond, Ph.D. Purdue, assistant professor of agricultural economics, University of Georgia.

Peter M. Emerson, Ph.D. Purdue, Marketing Economics Division, ERS, USDA.

Darrell Good, assistant professor, Cornell University.

Thomas E. Haller, Ph.D. Purdue, missionary/visiting professor, Commission on Ecumenical Missions and Relations, United Presbyterian Church, New York.

Zuhair A. Hassan, Ph.D. Missouri, research economist, Canada Department of Agriculture.

Harold Hiskey, Ph.D. Utah State, dean, College of Business, Southern Utah State College.

William M. Holroyd, Ph.D. Maryland, the Farmer Cooperative Service, USDA.

Richard D. Hunt, Ph.D. Minnesota, International Bank for Reconstruction and Development, Washington, D. C.

Bernard A. Kleiber, M.S. Wisconsin, Production Credit Association, Watertown, Wisconsin.

David E. Kunkel, Ph.D. Wisconsin, ERS, USDA, Washington, D. C.

Lily K. Lai, Ph.D. Wisconsin, econometric analyst, American Telephone and Telegraph, New York City.

Ollie C. Mason, M.S. Arkansas, assistant loan manager, Federal Land Bank, Lonoke, Arkansas.

Curtis E. McIntosh, Ph.D. University of Alberta, University of the West Indies, St. Augustine, Trinidad.

Muhammad Nazir, Ph.D. Utah State, employed in government service in his native Pakistan.

Gustavo A. Nores, Ph.D. Purdue, professor, Escuela para Graduados en Ciencias Agropecuarias, Capital Federal, Argentina.

Steven J. Pamperin, M.S. Wisconsin, auditor, First Bank Shares Corp., Milwaukee.

Allen M. Prindle, M.S. Purdue, research assistant, The Pennsylvania State University.

Don Reading, Ph.D. Utah State, staff member, Idaho State University.

Brian D. Riddell, M.S. Purdue, Swine Production Manager, Fresh Meats Division, Armour & Co., Joplin, Missouri.

Roland R. Robinson, Ph.D. Maryland, Cooperative State Research Service, USDA.

C. Robert Saathoff, Ph.D. Purdue, economist, Kroger Co., Cincinnati.

Lonnie Sievers, M.S. Missouri, research assistant to the vice president of distribution, Quaker Oats Co., Chicago.

Dwight L. Smith, M.S. Missouri, district salesman, Ralston Purina Co., central Iowa.

Richard Sorrells, M.S. Arkansas, assistant pastor, Central Baptist Church, Fayetteville, Arkansas.

Roy Supalla, assistant professor, New Mexico State.

Charles Robert Taylor, Ph.D. Missouri, research associate, Department of Agricultural Economics, University of Illinois.

Eduardo J. Trigo, Ph.D. Wisconsin, professor, Escuela para Graduados en Ciencias Agropecuarias, University of Buenos Aires, Argentina.

Mike Williams, M.S. Missouri, assistant manager, Orscheln Farm and Home Supply Co., Jefferson City, Missouri.

OBITUARIES

Roland C. Bevan, professor emeritus, University of Idaho, died suddenly on May 12, 1972, in Grandview, Washington.

Born in North Dakota in 1900, Bevan was a member of the Department of Agricultural Economics faculty at Idaho from 1946 until his retirement in 1967. His major contributions included teaching courses in farm management and appraisal and conducting farm cost and return studies in various sectors of Idaho agriculture.

Bevan, who held B.S. and M.S. degrees from Minnesota and a Ph.D. from Illinois, was a fieldman for the University of Minnesota farm record project prior to his tenure at Idaho. Following his retirement from Idaho, he was AID advisor to the Kenya Ministry of Agriculture in 1967-68 and an economic development consultant in Zaire (Congo) in 1969. At the time of his death he was serving as a part-time research associate in agricultural economics with Washington State University.

Julius Hendel, 76, retired senior vice president of Cargill, Inc., died March 17, 1972, in Minneapolis.

Between 1944 and 1955 Dr. Hendel was in charge of all Cargill marketing operations. After his retirement from Cargill, he became founder and first president of Experience, Inc., a Minneapolis-based management counseling firm.

Born in White Russia, he migrated to the United States in 1914 and attended Cornell University and the University of Minnesota where he received his Ph.D. in agricultural economics and biochemistry.

He joined Cargill in 1922 and organized and operated a biochemistry laboratory, making Cargill the first in its industry to analyze U. S. wheat supplies in terms of protein, moisture content, and

baking characteristics in relation to the geographic areas in which each wheat was grown.

Dr. Hendel was a founder and director of the U. S. Feed Grains Council and was chairman of the Board of McNary Farm Management Company. He was also a trustee and member of the Board of Governors of Mount Sinai Hospital, Minneapolis, on the council of Cornell University for six years, and a member of the American Agricultural Economics Association.

William Paul Walker, 72, a professor at the University of Maryland for more than 44 years, died Jan. 26, 1972.

A native of Mount Airy, Maryland, he earned both the B.S. and M.S. degrees from the University of Maryland and did advanced graduate study at South Dakota State College, American University, and the University of Maryland.

He counseled and taught graduate students in taxation and public finance. He authored or coauthored more than 100 research reports and other publications, mostly in the area of taxation and public finance. He pioneered the early work in the Maryland farmland tax assessment policies.

Walker worked closely with the Maryland Department of Taxation and was appointed to several commissions by four state governors. For more than 39 years he helped prepare the joint tax report of the Maryland State Grange and the Maryland Farm Bureau. Only recently, he compiled a study of Maryland's progressive farm assessment tax legislation.

He earned and received national and international recognition in his field. His many accomplishments were recognized by the Maryland State Grange in 1962 and by the Maryland Farm Bureau in 1966. In 1969 he was designated Maryland's "Man of the Year in Agriculture."

JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION

Volume 67

September 1972

Number 339

Applications

- The Effects of Discarding Inliers When Binomial Data Are Subject to Classification Errors ...Philip J. McCarthy
An Empirical Examination of the Classical Assumptions Concerning Errors in DataTracy W. Murray
On Constructing Current Life TablesChin Long Chiang
An Econometric-Linear Programming Model of the U. S. Petroleum Refining IndustryP. Gerard Adams and James M. Griffin
Some Aspects of the Aggregation Problem in the Dividend Earnings RelationshipP. Michael Lawb
A Synthesis of Time-Series and Cross-Section Analyses: Demand for Air Transportation ServiceKan Hua Young
Small Sample Estimation of a Structural Equation with Autocorrelated ErrorsMichael D. Hurd
Comparison of the Small Sample Power of the Chi Square and Likelihood Ratio Tests for Stochastic ModelsRobert W. Lissitz
Significance Testing of the Spearman Rank Correlation CoefficientJerrold H. Zar
Tables for Use of the Maximum *F*-Ratio in Multiple Comparison Procedures ...G. L. Tietjen and R. J. Beckman

Theory and Methods

- Design of Experiment for BioassayR. K. Tsutakawa
A Kolmogorov Goodness-of-Fit Test for Discontinuous DistributionsW. J. Conover
On the Selection of the Underlying Distribution and Adaptive EstimationRobert V. Hogg, Vincent A. Uthoff, Ronald H. Randles and Alan S. Davenport
Grouping for Testing Trends in Categorical DataRobert J. Connor
A Method for Detecting All Defective Members in a Population by Group TestingF. K. Hwang
On the Chi-Square Test When the Parameters Are Estimated Independently of the Sample ...Gerald R. Chase
A Simple Algorithm for Generating Binomial Random Variables When *N* is LargeDaniel A. Rellies
Population Projection Variances and Path AnalysisB. Seneta
A Note on Simulating the Small-Sample Properties of Econometric EstimatorsW. M. Mikhail
The Bias of the Two-Stage Least Squares EstimatorW. M. Mikhail
The Effect of Aggregation on Prediction in the Autoregressive ModelTakeshi Amemiya and Roland Y. Wu
Estimation of Actual Response Coefficients in the Hildreth-Houck Random Coefficient ModelW. E. Griffiths
Residual Correlations and Diagnostic Checking in Dynamic Disturbance Time Series Models ..David A. Pierce
A-Minimax Estimation of a Multivariate Location ParameterDaniel L. Solomon
A-Minimax Estimation of a Scale ParameterDaniel L. Solomon
The Estimation of Stationary Stochastic Regression Parameters ReexaminedBarr Rosenberg
On a New Class of Bounds for the Distribution of Quadratic Forms in Normal VariatesLeon Jay Glesser
Asymptotic Efficiency of One *R*-Factor Experiment Relative to *R* One-Factor Experiments for Selecting the Best Normal PopulationV. S. Bawa
Relation Between Pearsonian Coefficients of Distributions of Least Squares Estimators and the Disturbance TermP. N. Misra
Estimates of Parameters of a Censored Regression SampleEdwin H. Chen and W. J. Dixon
A Multivariate Extension of Tukey's One Degree of Freedom for Non-AdditivityLyman L. McDonald
Pooling Mean Squares in ANOVA Model IIS. R. Srivastava
Power of Tests of Homogeneity of a Binomial SeriesT. K. M. Wisniewski
Allocation in Stratified Sampling as a GameBenée F. Swindel and David O. Yandle
Constructing Confidence Sets Using Rank StatisticsDavid F. Bauer
Sequential Comparison of Exponential Survival CurvesNorman Breslow and Charlene Hwang
A Double Sampling Plan for Comparing Two VariancesR. K. Zeigler and Aaron Goldman
Some Comparisons of the Method of Moments and the Method of Maximum Likelihood in Estimating Parameters of a Mixture of Two Normal DensitiesW. Y. Tan and W. C. Chang
More Tables of the Power of the *F* TestM. L. Tiku
Optimality Properties of Theil's BLUS ResidualsStanley I. Grossman and George P. H. Styan
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No. 3

Articles

- Methods of Assessing Agricultural Demand for Water in the Prairies *Richard E. Capel*
Study on Coffee Prices—A Spectral Approach *A. Parikh*
On Combining Information Theory and Bayesian Analysis *Raymond M. Lenthold*
The Impact of Input Price Inflation on the United States Farming Industry
..... *Luther Tweeten and Leroy Quance*
Beef Production Functions From Sample Farms in Nova Scotia *Ching Y. Chao*
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Vol. XXIII, No. 2

May 1972

Contents

- An Appraisal of Contract Farming *G. R. Allen*
Policy Direction and Economic Interpretations of the US Agricultural Act of 1970 *R. G. F. Spijze*
Interactions of Quantity, Price and Policy: Milk and Dairy Products
..... *T. W. Gardner and Rosemary Walker*
Implications of Aggregation Bias for the Construction of Static and Dynamic Linear Programming
Supply Models *Allan A. Buckwell and Peter B. R. Hazell*
An Analysis of Peasant Farm Production under Conditions of Uncertainty *J. Heyer*
A Model for Determining Optimal Marketing and Feeding Policies for Beef Cattle .. *J. O. S. Kennedy*
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August 1972

No. 2

Contents

The Outlook for Agricultural Economics	John L. Dillon
Chance and Choice West of the Darling	Emilio M. Francisco and Jock R. Anderson
Some Circumstances in Which Price Stabilization by the Wool Commission Reduces Incomes ..	C. Tisdell
A Negative Income Tax and Low Income Farm Families	A. H. Chisholm
The Integrated Use of Simulation and Stochastic Programming for Whole Farm Planning under Risk	D. B. Trebeck and J. B. Hardaker
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June, 1972

Some Economic Consequences of Anticipating Technical Advance	<i>Morton I. Kamien and Nancy L. Schwartz</i>
Optimality Conditions in Certain Models with Intertemporally Dependent Tastes	<i>D. Glycopantis</i>
The Relative Quality of Economics Journals: A Suggested Rating System	<i>William J. Moore</i>
Discrimination in the International Transportation Industry	<i>Lawrence H. Officer</i>
On Organized Markets Under Uncertainty	<i>Norman P. Obst</i>
A Correction: On the Geneology of the So-Called Edgeworth-Bowley Diagram ...	<i>Vincent J. Tarascio</i>
Achievement, Costs, and the Demand for Public Education	<i>Byron W. Brown</i>
The Western Agora	
Conference Program, Fiftieth Anniversary of the Western Economic Association	

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Correspondence with regard to membership in the Western Economic Association, subscriptions to the *Journal*, and other business matters should be addressed to the Secretary-Treasurer, Professor Eldon J. Dvorak, Department of Economics, California State University, Long Beach, California, 90840. Membership dues, including the *Journal*: one year, \$9; three years, \$24. Student membership, \$5. Library subscription, \$10.

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Volume 45

JULY 1972

Number 3

Development Cost: Determinants and Overruns	<i>Jerome E. Schnee</i>
Some Empirical Findings on the Legal Costs of Patenting	<i>Richard L. Sandor</i>
Regulation and Excess Demand: A General-Equilibrium Approach	<i>Jacob A. Frenkel and B. Peter Pashigian</i>
Government Securities and the Cyclical Investment Behavior of Corporations and Commercial Banks: A Note	<i>Gloria Shatto</i>
Empirical Evidence of the Adoption of Sophisticated Capital Budgeting Techniques	<i>Thomas Klammer</i>
Approximations to Interest Formulas	<i>Yuji Ijiri</i>
The Informational Content of Quarterly Earnings: An Extension and Some Further Evidence ..	<i>Philip Brown and John W. Kennelly</i>
On Balance-of-Payments Payback Periods	<i>Michael Adler and G. C. Hufbauer</i>
On Balance-of-Payments Payback Periods: A Reply	<i>G. E. Makinen</i>
Returns on Alternative Investment Media and Implications for Portfolio Construction	<i>Alexander A. Robichek, Richard A. Cohn, and John J. Pringle</i>
Capital Market Equilibrium with Restricted Borrowing	<i>Fischer Black</i>
Books Reviewed	Books Received
Notes	

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Secretary-Treasurer

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HANDBOOK-DIRECTORY

EDITED BY

JOHN C. REDMAN

WILLETTA HAGER

MICHELLE STOKES

PEGGY RILEY

Volume 54 No. 4

Part III

November 1972

ABBREVIATIONS

The following abbreviations are frequently used in this handbook

A, article	cons., conservation, consultant
A.A., Associate in Arts	consol., consolidated
AAA, Agricultural Adjustment Administration	coop., cooperation, cooperative
A&M, Agricultural and Mechanical	corresp., correspondent
acad., academy	cr., credit
acct., accountant	CSS, Commodity Stabilization Service
acctg., accounting	ct., court
adm., administration, administrative	demons., demonstration
administr., administrator	dep., deputy
adv., advancement, advisory	dept., department
AEA, American Economic Association	devl., development
agt., agent	dipl., diploma
agr., agricultural, agriculture	dir., director, directory
agron., agronomist, agronomy	dist., district
AID, Agency for International Development	distr., distribution
Am., American, America	div., division
AMS, Agricultural Marketing Service	dom., domestic
anal., analyst, analytical	D.P.A., Doctor of Public Administration
appr., appraisal, appraiser	
ARS, Agricultural Research Service	E., east, eastern
assn., association	ECA, Economic Cooperation Administration
assoc., associate	econ., economics, economist
asst., assistant	economet., econometric
assur., assurance	edit., editorial
att., attended	educ., education
ave., avenue	elem., elementary
	emerg., emergency
bk., book	empl., employment
b., born	enrg., engineer
B.A., Bachelor of Arts	engrg., engineering
BAE, Bureau of Agricultural Economics	equip., equipment
bd., board	equit., equitable
bkkpr., bookkeeper	enum., enumerator
blvd., boulevard	ERS, Economic Research Service
br., branch	exam., examiner
bul., bulletin	exec., executive
B.S., Bachelor of Science	expt., experiment
bur., bureau	ext., extension
bus., business	
	FAO, Food and Agriculture Organization
CAES, Canadian Agricultural Economic Society	FAS, Foreign Agricultural Service
CA, California	FCA, Farm Credit Administration
CCC, Commodity Credit Corporation	FCIC, Federal Crop Insurance Corporation
CEA, Commodity Exchange Authority	FCS, Farmers Cooperative Service
certif., certificate	fed., federal
chap., chapter	fedn., federation
chf., chief	FEA, Foreign Economic Administration
chmn., chairman	FERD, Farm Economic Research Division
co., company, county	FES, Federal Extension Service
coll., college	FHA, Farmers Home Administration
comm., committee, commission	Fields: principle field listed, others signified by capital letters, see questionnaire
commr., commissioner	fin., finance, financial
conf., conference	found., foundation
cong., congress, congressional	for., foreign

FPED, Farm Production Economics
Division
FS, Forest Service
FSA, Farm Security Administration

G.E., General Electric
gen., general
govt., government
govtl., governmental
grad., graduate

handbk., handbook
H.S., high school
hist., historical, history
hon., honorary
husb., husbandary

ICA, International Cooperative
Administration
impl., implement
incl., inclusive
ind., industry
indsl., industrial
inf., information
ins., insurance
inst., institute, institution
insp., inspector
instr., instructor
int., interior
intl., international

JFE, Journal of Farm Economics
jour., journal
jr., junior

lab., laboratory
ldr., leader
lectr., lecturer
legis., legislation, legislative
L.H.D. Doctor of Humanities
libr., library
LL.B., Bachelor of Laws
LL.D., Doctor of Laws
M., monograph
m., married
M.A., Master of Arts
magz., magazine
Math., mathematics
M.B.A., Master of Business
Administration
mdse., merchandise
MED, Marketing Economic Division
mem., member
MERD, Marketing Economic Research
Division
meth., methodology
metro., metropolitan
mfr., manufacturer
mng., manage, managing
mgr., manager
mgmt., management
mktg., marketing
M.S., Master of Science

MSA, Mutual Security Agency
mtg., mortgage

N., North
natl., National
N.E., Northeast
NRA, National Recovery Administration
NRED, Natural Resource Economics
Division
nutr., nutrition
N.W. northwest

OPA, Office of Price Administration
oper., operations, operator
org., organization

Pac., Pacific
Ph.D., Doctor of Philosophy
PMA, Production and Marketing
Administration
plng., planning
pol., political
poly., polytechnic
pres., president
prin., principal
prod., production, products
prof., professor
proj., project
P.S. public school
pub., public, publishing
purch., purchasing

quart., quarterly

REA, Rural Electrification
Administration
reconstr., reconstruction
reclam., reclamation
ref., reference
reg., regional
rehab., rehabilitation
rel., relations
reset., resettlement
res., research
rev., review, revised
rep., representative
repay., repayment
rptg., reporting
R.R., railroad
rur., rural
rwy., railway

S., south
sch., school
sci., science
SCS, Soil Conservation Service
S.E. southeast
SEA, Southern Economic Association
sect., section
sec., secretary
serv., service
so., southern
soc., society, sociology

socio., sociological
spec., specialist
sr., senior
st., state, street
sta., station
SRS, Statistical Reporting
Service
stat., statistical, statistician,
statistics
supt., superintendent
supvr., supervisor
supvry., supervisory
S.W., southwest

TCA, Technical Cooperation
Administration
techr., teacher
teach., teaching
tech., technical
techn., technology, technological
tr., trust
transp., transportation
treas., treasurer
trng., training
TVA, Tennessee Valley Authority
twp., township

UN, United Nations
univ., university
U, unmarried
UNRRA, United Nations Relief and
Rehabilitation Administration
USDA, United States Department of
Agriculture
USFS, United States Foreign
Service

veg., vegetable
vet., veteran
voc., vocational
v. pres., vice president

W., West, western
WAEA, Western Agricultural Economics
Association
wkly., weekly
WPB, War Production Board
WPA, Works Progress Administration
wts., weights

yrbk., yearbook

Fill out and return promptly to John C. Redman, AAEA, Dept. of Agricultural Economics, Univ. of Kentucky, Lexington, Ky. 40506. NO FOLLOW UP WILL BE SENT...The deadline for inclusion in the directory is JULY 15, 1971.

"WHO'S WHO" DIRECTORY - 1971

The American Agricultural Economics Association will publish in 1971 a special biographical directory of its members under the title, THE HANDBOOK/DIRECTORY OF THE AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION. Since another directory of this form probably will not be published in the next 5 to 7 years, we urge you to fill out and return this questionnaire before the deadline so that this volume may be as complete as possible. Immediate response will enable us to start processing returns at once. Neither time nor funds will permit follow up requests.

USE TYPEWRITER IF POSSIBLE - OTHERWISE PRINT PLAINLY

Last Name	First Name	Middle Name
-----------	------------	-------------

Mailing Address (Office) _____

City	State	Zip Code	Office Phone
------	-------	----------	--------------

1. Present employment: Academic _____ Industry _____ Government _____ Other _____

Rank or title	Institution, agency or firm
---------------	-----------------------------

2. Nature or present activity: Rank in order of importance or time spent - 1, 2, 3

<input type="checkbox"/> Business <input type="checkbox"/> Marketing <input type="checkbox"/> Adm or Operations <input type="checkbox"/> Finance <input type="checkbox"/> Research <input type="checkbox"/> _____	<input type="checkbox"/> Academic <input type="checkbox"/> Teaching <input type="checkbox"/> Research <input type="checkbox"/> Extension <input type="checkbox"/> Adm <input type="checkbox"/> _____	<input type="checkbox"/> Government <input type="checkbox"/> Research <input type="checkbox"/> Extension <input type="checkbox"/> Regulatory <input type="checkbox"/> Service <input type="checkbox"/> Adm <input type="checkbox"/> _____	<input type="checkbox"/> Editorial <input type="checkbox"/> Consulting <input type="checkbox"/> Service Work <input type="checkbox"/> Elective Pub Office <input type="checkbox"/> Farming <input type="checkbox"/> _____
--	---	---	---

3. State or country and year of birth _____

4. Family Status: Married ☐ Widowed ☐
 Divorced ☐ Unmarried ☐ Number of Children _____

5. Education and academic or professional degrees:

Degrees (if honorary please indicate)	Year granted	Years attended (state only if no degree awarded)	Colleges and Universities
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

6. Fields of specialization or major interest: Indicate, in the order of interest for not more than four fields by inserting 1, 2, 3 and 4 in the appropriate boxes below. Each member will be listed according to his first choice of general field in the tabulated classification. Second, third and fourth fields will be indicated by letters following name.

- | | |
|---|--|
| () A. Farm Management & Prod Econ | () G. Statistics & Methodology |
| () B. Agricultural Marketing | () H. Econometrics |
| () C. Agricultural Prices | () I. Economics of Food & Nutrition |
| () D. Agricultural Finance & Credit | () J. World Agricultural Production & Trade |
| () E. Land & Water Economics
Conservation & Development | () K. Economic Development |
| () F. Agricultural Policy | () L. General Economic Theory |

7. Employment record other than present: List important positions, most recent first.

Rank or title	Institutions, agency or firm	Location	Approximate Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8. Research currently in process: Give title of major project or area of research _____

9. Publications: List only in order of importance.

Title	Where Published	Year of Publication
_____	_____	_____
_____	_____	_____
_____	_____	_____

10. Proficiency in language other than native tongue: Indicate degree of proficiency as 1, 2 or 3 for good, fair, poor

Language	Read	Write	Speak
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

11. List memberships in associations. Indicate offices held, with dates.

_____	_____
_____	_____

12. Other directories: Check "Who's Who" directories in which you are listed.

_____ Who's Who in America	_____ International Who's Who (Europa)
_____ Directory of American Scholars	_____ American Men of Science
_____ Leaders in Education	_____

13. Honors: _____

(Membership dues of \$15.00 for Regular members - \$5.00 for Junior members - must be paid for 1971 or enclosed with this form in order to be listed)

AANDERUD, Wallace G., Dept. of Agr. Econ. South Dakota State Univ. Brookings, SD, 57006; PH 688-4141; Prof; A-2,3; b. ND 1924; M-3; B.S. ND State Univ. 1950; M.S. ND State Univ. 1960; PhD, OK State Univ. 1964; Fields: Farm Mgmt. & Prod. Econ. Res: Econ. of Beef Cows in Southeast SD; Member: AFM, WAEA; Asst. Mkt. Econ. ND State Univ. 58-60; Pub: Guidebook for Planning, 1970; Ten Steps in Planning, 1969; Practical Hog Prod. 1969; Irrigation Costs and Returns, 1970.

ABBADI, Karrar A. Dept of Agr. Econ. Univ. of Wisconsin, Madison WI 53706; Grad. Student; A-5; b. Sudan, 1943; D; B.S. Univ. of Khartoum, 1967; Fields: Econ. Devl., FAD; Res: Devl. of Khash-melgirba Scheme in Sudan; Lang: Eng. 1,2,2; Asst. Lectr. Sudan 67-70.

ABBOTT, John C. FAO, Rome, Italy, PH 5797; Chief; B-2,4; b. England 1919; M-3; B.A. Cambridge Univ. 1946; M.A. Cambridge Univ. 1948; PhD Univ. of CA 1953; Fields: Credit Org. in Developing Countries; Lang: Fr. 1,1,1; Ita. 1,1,1; Sp. 1,1,2; Member: IAAE, CAES, AEA; Dep. Dir. FAO 66-68; Chief, Mktg. Br., 55-65; Instr. Univ. of CA 52-54; Asst. Oxford Univ. 47-49; Pub: Agr. Mktg. Bds. 1968; Rice Mktg. 1971; Mktg. Problems and Improvement Programs, 1958.

ABEL, Fred H. 500 12th St. SW, Room 494, Washington DC 20250; Leader; G-1,5; b. MI, 1936; M-3; B.S. MI State Univ. 1959; M.S. Univ of DE 1961; PhD MI State Univ. 1967; Fields: Econometrics, KGE; Res: Domestic Rural Area Devl; Member: AEA, SAEA, IAAE, RSA; Agr. Econ. FPED-ERS, 65-68; Pub: Problems of Land Use Change, 1971 An Econ. Anal. of Mktg. Delaware Potatoes, 1962; Mic. Agr. Co. Date and State Trends 1962.

ABEL, Martin E. Dept. of Agr. & Applied Econ. Univ. of MN, St. Paul MN 55101, PH 612-373-1757; Prof; A-2,1; b. NY 1934; M-3; B.S. Cornell Univ. 1956; PhD, Univ. of MN 1961; Fields: Econ. Devl. FCJ; Res: Reg. Agr. Planning for Agr. Devl; Lang: Sp. 2,3,3; Member: AEA, ASA, ES; Dir: 5; Program Adv. in Econ. Ford Found. 69-71; Prof. Univ of MN 68-69; Dep. Asst. Sec. USDA 67-68; Econ. ERS-USDA, 61-67; Pub: Policies for Expanding the Demand for Farm Products in the U.S. 59-61; World Food Situation; Prospects for World Grain Prod. Consumption and Trade, 1967.

ABLASSER, Gottfried, World Bank, 1818 H Street, NW Washington DC 20433; PH 477-2084, Econ; O-6; b. Austria, 1938; U; B.S. Univ of Vienna, 1962; M.S. Univ of IL 1964; PHD, Univ of IL 1967; Fields: Econ Devl. HD; Res: Agr. Sector Planning Model for Brazil; Lang: Eng. 1,1,1; Sp. 1,2,2; Mem: CAES; Econ. Canada Dept of Agr. Prod. 1968; Farm Real Estate Sales in the Prairie Provinces of Canada, 63-67-69; Price: A Guiding Mechanism for Prod. and Consumption 1964.

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ABRAHAMSEN, Martin A. Farmer Coop. Ser. USDA, Washington DC 20250; PH 963-3857; Dep. Admin; G-5; b. WI 1908; M-1; B.E. River Falls Teachers College 1930; M.A. Univ of WI 1933; PhD Univ of WI 1940; Fields: Agr. Mktg; Res: Coop. Growth; Lang: Nor. 2,2,0; Swe. 2,2,0; Mem: CC, AMA; Dir: 5; Dir. Purchasing Div. USDA 54-62; Head Purchasing Div. Farm Cr. Adm. 49-54; Pub: Readings in Agr. Coop. 1957; Bus. Res. of Reg. Farm Supply Coops, 1955; A Look at Agr. Coop. in India, 1961.

ABRAM, Rienhart, Gentzgasse 23, Vienna, Austria, A-1180; Post Grad. Res. Econ; A-2; b. Austria; M-1; Diplomegenieue, Agr. Univ of Vienna, 1966; M.S. Univ of CA 1970; Res: Prod. Scheduling and Inventory Mgr; A Cost Study of the Col. Olive Ind; Lang: Fr. 3,0,0; Eng. 1,1,1.

ABSHIER, George S. 201 Whitehurst Hall, OK State Univ. Stillwater OK 74074, PH 372-6211; Prof. & Dir; A-4,3; b. IN 1919; M-3; B.S. Purdue Univ 1941; M.S. Univ of MD 1942; PhD Purdue Univ 1948; Fields: Econ. Devl. FEB; Mem: CDS, ACLA, ISCD; Dir: 5; Ext. Econ. NC State Univ. 50-59; Ext. Econ. Purdue Univ 48-50; Asst. Co. Agt. Ext. Ser. IN, 1942; Pub: Management for Agr. Mktg. Firms, 1959.

ABUKISHK, Bakir A.M. Iowa State Univ. Dept. of Agr. Econ. Ames IA 50010; Head; A-2, G-5,6; b. Israel; M-4; B.S. UT St. Univ. 1957; Fields: Farm Mgmt. & Prod Econ. EFK;

Res: Resource Utilization for Reg. Devl;
Lang: Heb. 1,1,1; Eng. 1,1,1; Pub: Found.
of Agr. (4 Vol.) 1960.

ABU-HWEIJ, Burham S. Ministry of Agr.,
Amman, Jordan.

ACHARYA, Shadb S. Div. of Agr. Econ.,
I.A.R.I., New Delhi 12 India; Reader;
A-1,2,3; b. India 1939; M-2; B.S. Univ.
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Univ. 1966; Fields: Econometrics, A,G;
Res: Impact of Green Revolution on In-
come and Employment; Lang: Eng. 1,1,1;
Member: ISA, Lectr. Univ. of Udaipur 66-
69- Agr. Officer, Dept. of Agr. Rajas-
than Univ. 59-66; Pub: Study of Mgmt.
Input on Farming, 1967; Econ. of High
Yielding Variety Program, 1969; Re-
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1967.

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Coll. 1941; J.D. Fordham LAW School
1945; Fields: Agr. Policy CIJ; Lang: Fr.
2,0,0; Ger. 2,0,0; Member: AEA, APSA;
Pub: The Convenience Food Mfg. Ind.
1963; Japanese Silk Industry, 1961.

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46951; Proj. Spec. 0-2; b. IL 1904; M-4;
B.S. Univ. of IL 1929; M.S. Univ. of IL
1930; PhD Univ. of IL 1938; Fields: Farm
Mgmt. & Prod. Econ. DEF; Lang: Ger. 2,3,2;
Fr. 2,0,0; Sp. 2,0,3; Member: ACLA, ASFMRA,
IAAE; Dir: 1,2,3,4,5; Proj. Spec. Ford
Found. 70-72; Hon: AZ, GSD, PES.

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B.S. OH State Univ. 1964; M.S. Southern IL
Univ. 1966; Fields: Agr. Mktg. C,G,H; Res:
Farmer Cooperatives Coordinated Transpor-
tation; Pub: Stat. of Farmer Co-ops. 1970;
Grain Co-op Inventory Control, 1967.

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b. OH 1938; M-4; B.S. OH State Univ. 1960,
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1970; Fields: Farm Mgmt. & Prod. Econ. E,G;
Res: Turkey Prod. & Scheduling; Lang: Fr.
3,0,0.

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State Univ. 1956; M.S. MI State Univ.
1961; PhD MI State Univ. 1964; Fields:
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Rural Savings in LDC's; Lang. Sp. 1,1,1;
Port. 1,3,2; Member: AEA; Staff Econ.
Agency for Intl. Devl. 68-69; Asst. Prof.
Univ. of WI 1964-66; Pub: Agr. Credit
in Latin Am. 1971; Aid Agencies and
Land Reform, 1970; Rural Migration &
Agr. Devl. in Columbia 1969.

ADAMS, Kendall A. Mktg. Dept., Southern
IL Univ. Carbondale IL 62901; PH 618-
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1926; M-2; B.S. OR State Univ. 1951;
M.S. MI State Univ. 1953; PhD MI State
Univ. 1962; Fields: Agr. Mktg. KJ;
Lang: Sp. 2,2,1; Member: AMA, AFEA, FDRS,
SED; Dir: 5; Assoc. Prof. Southern IL
Univ. 65- --; Proj. Spec. Ford Found.
67-69; Asst. Prof. AZ State Univ. 62-
65; Grad. Res. MI State Univ. 54-62;
Pub: Achieving Mkt. Organization through
voluntary & Cooperatives Groups, 1966;
Resource Utilization by Meat Retailers
in a Devl. Economy 1970; Hon: BGS.

ADAMS, Thomas C. P.O. Box 3141, Port-
land OR 97208; PH 234-3361; Econ; G-1,
4; b. CA 1918; M-2; B.S. Univ. of CA
1940; M.A. Univ. of MI 1950; PhD Univ.
of MI 1952; Fields: Land & Water Econ.
Conservation DEVL., KJ; Res: Sales
Arrangements for Increased Utilization
of Forest Thinnings and Other Wood
Materials; Lang: Sp. 2,0,0; Fr. 3,0,0;
Sw. 3,0,0; Member: SAF, RSA, AFA, WAEA;
Dir: 5; Asst. Prof., OR State Univ. 55-
57; Pub: Cooperative and Federal Sus-
tained Yield Forest Units, 1952.

ADKINSON, Leslie B., 1316 Dickson, Fort
Worth, TX 76110.

ADOLPHE, Dale D. Lamb-Weston, Inc. P.O.
Box 652, Connel, WA 99326; PH 234-5511;
Field Rep; B-2,1,3; b. MT 1948; M-1;
B.S. MT State Univ. 1970; Fields: Farm
Mgmt & Prod. Econ. B,E,K; Lang: Ger.
3,0,0; Lab. Instr. MT State Univ. 1969-
1970; Employee, Mt. State Highway Comm.
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AGANOGLU, Ali, Okul Sokak 29, Suadiye, Istanbul, Turkey; Sen; G-6; b. Turkey, 1916; U; M.A. Ankara Univ; Fields: Agr. Finance & Credit, FKJ; Res: Agr. Land Problems in Turkey; Lang: Eng. 1,1,1; Member: TMA, SECA, PC; Directory: 4; Deputy, Parliament, Turkey 61-65; Pres. Turkish Comm. Bank, 60-61; Pub: Agr. Econ. in the U.S. of America.

AGRAWAL, Babu Lal, Econ. Anal. Div., FAO, UN, Rome, Italy 00100, PH 5797; Econ; G-4,6,5; b. India 1926; M-3; B.S. Agra Univ. 1947; M.S. Agra Univ. 1949; PhD Cornell Univ. 1958; Fields: Econ. Devl. FDA; Lang: Eng. 1,1,1; Member: ISAE, IAAE; Agr. Econ. FAO, 66-69; Agr. Econ. Indian Agr. Res., Instr. 62-66; Rur. Credit Officer, Reserve Bank of India, 60-62; Dir. of Training, Indian Coop. Union, 58-60.

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Attitudes Toward Fluid Milk Substitutes, 1969; Cost and Profit Comparisons of Baling and Cubing Hay, 1970; Consumer Preference and Acceptance, 1962; Hon: ODE, GSB.

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in OECD Countries; Instr. LA State Univ. 65-67; Pub: The Econ-Feasibility of Soybean Oil Milling in South Central LA, 1966; Costs of Producing Broilers Under Contract in LA, 1967.

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Math. Programming Applied to Forest Prod. Processes; Dev. of Forest Mgmt. Games; Lang: Fr. 2,3,3; Member: IMS, SAF; Dir: 5; Instr. Purdue Univ. 68-69; NGEA Fellow, Purdue's Forest Mgmt. Games, 1970.

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BEATON, Norman J. Dept. of Agr. Econ. Univ. of Manitoba, Winnipeg 19, Man. Canada; Asst. Prof; A-1,2,3; b. Canada; U; B.S. McGill Univ. 1962; MS ND State Univ. 1965; PhD KS State Univ. 1968; Fields: Agr. Mktg; ADF; Res: Agri. Bus; Lang: Fr. 2,2,1; Member: AEA, CAES, CEA; Dir: 5; Res. Asst. KS State Univ. 65-68; Res. Asst. ND State Univ. 63-65; Pub: Econ. Characteristics of KS Livestock Auctions 1970; Hon: ODE.

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Primary Res. AID India, 1970; Member of Task Force, Nepal, 1967; Pub: Essentials for Planning Instructional Programs in Agr. Resource; Hon: GSD.

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BELL, Thomas M., P.O. Box DB, MS. State Univ., State College MS 39762; PH 325-5904; Asst. Prof; A-1,2; b. MS 1941; M-1; B.S. MS. State Univ. 1966; M.S. MS State Univ. 1967; PhD Univ. of IL 1969; Fields: Economet. GKL; Res: Econ. Forecasting; Lang: Fr. 1,2,3; Ger. 3,3,3; Member: ES, AEA, SEA, ASA; Asst. Prof. GA State Univ. 69-70.

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Univ. of KY 62-64; Pub: Pricing in Ky. Fertilizer Mkt. 1965; Conventional & Unconventional Detrs. of Mkt. Performance. 1964; Changes in the Number of Farms & Farmers in the U.S. 1966.

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65-67; Survey Stat. U.S. Bureau of Census,
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Price Stabilization for the Argentine Grape
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Econ. EDA USDA 66-67; Group Leader, ERS USDA
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An Exploration 1971; Reg. Devl. Strategies
in Relation to Rural People - Some Alterna-
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5; Agr. Econ. USDA Univ. of MO 56-65;
Agr. Econ. USDA Washington DC 51-56; Agr.
Econ. USDA Univ. of W. V. 49-51; Agr.
Econ. ID State Tax Comm. 47-49; Pub:
Status of Rural Housing in the U.S. 1968;
Income Opportunities from Rural Recn.
Enterprises, 1965; Contr. of Tourist
Trade to Income of Rural People in
Ozarks, 1962; Hon: AZ, GSD.

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1,1,1; Ger. 1,1,1; Eng. 1,1,1; Member:
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56-59; Pub: Interregional Programming
Model of Agr. Prod. in Sweden 1966;
Linear Programming Theory 1970.

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FKJ; Res: Study of the Econ; Lang: Sp. 2, 2,3; Eng. 1,1,1; Mem: CAES, SID, CDQ, CCPI; Econ. Counselor - Union Catholique Des Cultivateurs 67-71; Pub: The Use of Multi-Period Linear Programming in Planning a Model Form 1965.

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M-3; B.S. MT State Univ. 1953; M.S. Purdue Univ. 1967; PhD Purdue Univ. 1971; Fields: Agr. Mktg. AFE; Res: Behavioral Anal. of Mgrs. in Farm Input Supply Ind; Lang: Fr. 3,0,0; Mem: NEA; Instr. Purdue Univ. 67-70; Instr. High School 56-64; Instr. Joliet High School 53-56; Pub: Manuel for Purdue Farm Supply Mgmt. Game 1969; Hon: PKP, SX.

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BOLMAN, Ray D. Dept. of Agr. Econ. Univ. of Manitoba, Winnipeg, Man. Canada; PH 474-9309; Grad. Stud; A-2,5; b. Canada 1948; M-0; B.S. Univ. of Manitoba 1970; Fields: General Econ. Theory Res: Household Research; Lang: Eng. 1,1,1; Fr. 1,1,1; Mem: AEA, CEA, CAES; Res. Asst. Univ. of Manitoba 68-70.

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Inst. 53-56; Asst. Dir. Mktg. Dept. AFBF, 48-50; Insp. R.R. Perishable Insp. Agency 43-46.

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BORTON, Raymond E. Dept. of Agr. Econ., UPCA College, Laguna, Philippines; Assoc. Vis. Prof; A-1,4; b. MI 1931; M-1; B.S. Cornell Univ. 1954; M.S. MI State Univ. 1957; PhD MT State Univ. 1964; Fields: Land & Water Econ. Cons. & Devl. JFK; Res: Improvement of Teachers in Agr. Econ. At Philippines Coll. & Univ; Lang: Sp. 2,3,3; Mem: SID, AEA, PAEA; Agr. Econ. Stanford Res. Inst. 67-69; Spec. Agr. Devl. Council 40-67; Res. Asst. MT State Univ. 61-64; Pub: Case Studies to Accompany Getting Agr. Moving 1967; Selected Readings to Accompany Getting Agr. Moving, 1966; Irrigation on the Crow Reservation 1964.

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Mem: AAAS, NWWATD; Econ. USDA 70 - --; Res. Assoc. Univ. of AZ 69-70; NDEA Fellow, Univ. of AZ 67-69; Pub: Critical Appraisal of the Environmental Movement 1971; Ground Water & the Environmental Movement, 1971; Hon: ODE, SSX.

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BOUTWELL, Wayne A. Dept. of Agr. Econ. VPI & State Univ. Blacksburg VA 24061; PH 552-6847; Agr. Econ; G-1; b. MS; M-1; B.S. MS State Univ. 1966; M.S. MS State Univ. 1968; PhD VPI 1972; Fields: Agr. Mktg. C; Res: Grain Mktg; Pub: Programming & Scheduling Broiler Prod. 1968; Survey Tabulation & Summarization Program, 1970; Hon: GSD.

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BOXLEY, Robert F. NRED ERS USDA, Washington, DC 20250; PH 962-2002; Econ; G-1; b. VA 1934; M; B.S. VPI 1956; M.S. VPI 1963; PhD MI State Univ. 1969; Fields: Land & Water Econ. Cons. & Devl. GF; Lang: Ger. 2,3,2; Mem: AEA, WAEA; Pub: Land Values & Flood Risk, 1969; Non-Parametric Stat. 1966; White & Non-White Landowners in the Southeast, 1965.

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the Real Wealth Position of Farm Oper. 1964; Mkt. Structure Variables & the Anal. of Firm Behavior.

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BRINKMAN, George L. 317 Waters Hall, KS State Univ. Manhattan KS 66502; PH 532-6241; Asst. Prof; A-2,1; b. MN 1942; M-2; B.S. WA State Univ. 1964; Ext. M. WA State Univ. 1965; PhD MI State Univ. 1969; Fields: Econ Devl. JF; Res: Rur. Ind. Devl; Lang: Ger. 1,1,1; Fr. 2,2,2; Mem: CDS; Grad. Res. Asst. MI. State Univ. 1965-1969; Pub: Reconciling Proposed Investments in Agr. Education Infrastructure & Prod. in Nigeria 1969-1985 (pub. 1969) Hon: PKP, AZ, ODE.

BRINTS, Norman W. Box 2159, Vernon TX 76384
PH 817-552-2571; A-3; b. TX 1939; M-2; B.S.
TX Tech. Univ. 1962; M.S. Univ. of AR 1964;
Fields: Farm Mgmt. & Prod. Econ. D; Mem:
Tx. SFMRA; Instr Univ. of AR 63-64; Pub:
Rolling Plains Econ. Program 67; Crop En-
terprises on Cotton Farms in N.E. AR 1964.

BRITNEY, John B. Box 1024, Canfarm, Guelph,
Ontario, Canada; PH 821-8000; Dir. of Res.
& Devl; G-5,1; b. Canada 1936; M-2; B.S.
Univ. of Guelph, 1960; M.S. Purdue Univ.
1962; PhD Purdue Univ. 1964; Fields: Farm
Mgmt. & Prod. Econ. D; Mem: CAES; Assoc.
Prof. Univ. of Guelph 64-69; Stat. Canada
Packers, Ltd. 63-64; Pub: Computed Package
for Feed Mills, 1968.

BRITTON, Denis K. Wye College, Ashford,
Kent, England WYE 401; Prof; A-4,1,2;
b. United Kingdom 1920; M-0; B.S. London
Univ. 1940; M.A. Oxford Univ. 1948; Fields:
Agr. Policy, GJA; Res: Farm Structure in
European Countries; Lang: Fr. 1,2,2; Ger
2,3,2; Mem: AES; Directory: 4; Prof. Univ.
of Nottingham 61-70; Dean of Faculty of
Agr. Horticulture 67-70; Econ. FAO 52-59;
Pub: Cereals in the United Kingdom 1969.

BRIZ, Julian E. Alonso Tobar II, Madrid
(18) Spain; Asst. Prof; A-1, b. Spain
1942; U; Ingeniero Agronomo Madrid 1968;
Master Agr. Econ. MN 1970; Fields: Agr.
Mktg. CHK; Res: Eruopean Agr. Mkts;
Lang. Eng. 1,1,1; Fr. 1,2,2; Ingenerio,
Mins. of Agr. 1968.

Broadbent, Emer E. 305 Mumford Hall, Univ
of IL, Urbana IL 61801; PH 333-1827; Prof;
B-1, A-2,1, G-1,4; b. Utah 1915; M-5;
B.S. UT State Univ. 1942; M.S. UT State
Univ. 1947; PhD Univ. of IL 1950; Fields:
Agr. Mktg. CKJ; Res. Econ. of Meat Extend-
ers, Cost of Mktg. Oper. Pricing Livestock
& Meats in Changing Econ; Lang: Sp. 3,0,0;
Fr. 3,0,0; Prof. Univ. of IL 1947- --;
Asst. Prof. OH State Univ. 42-46; Pub: Oper.
Efficiency of Country Mkts. 1971; Transition
in the National Studies of Mkt. 1971; Mkt.
Combination Systems in Pork Ind. 1971.

BROCK, Donald E. Room 200-A USDA Washington
DC 20250; Adm. Asst. to Sec. Agr; G-5; b.
CA 1941; M-1; B.S. Univ. of CA 1964; Fields:
Farm Mgmt. & Prod. Econ. JBF; Lang: Sp.
2,2,2; Mem: C.C. of C; Dir: 1; Dist. Mgr
Freshpiot Inc. 68-69; Pres. Brock Res. Inc.
67-69.

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Prof; A-2,1,3; b. IL 1933; M-3; B.S. Univ.
of MI 1956; MF Univ. of MI 1956; PhD Univ.
of MN 1963; Fields: Land & Water Econ. Cons.&

Devl. LGF; Res: Benefit, Cost Anal. of
Strip Coal Mining; Lang: Ger. 2,3,3;
Mem: AEA, SAF; Dir: 5; Econ. Bureau
of Land Mgmt. 64-65; Asst. Prof. Univ.
of ME 1960-1964; Pub: The Mineral Ind.
& the Environment; Hon: PKD.

BRODIE, John D. Dept. of Forestry, Univ
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Prof; A-2,1,4; b. Toronto, Canada 1938;
M-0; B.S. Univ. of Toronto 1961; M.S.
Syracuse Univ. 1963; PhD Univ. of CA 1971;
Fields: Land & Water Econ Cons. & Devl. G;
Acting Asst. Prof. Univ. of CA 1969; Econ.
III Ontario Dept. of Agr. Econ. Canada,
1963-65.

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Econ; G-1,5,4; b. GA 1942; M; B.S. Univ
of GA 1964; M.S. Univ. of GA 1966; Fields:
Farm Mgmt. & Prod. Econ. DGL; Res: Econ
Anal. of the Growth of Beef Cattle Farms
in FL; Lang: Fr. 2,0,0; Mem: SAEA, AEA;
Pub: Econ. & Operational Characteristics
of Beef Cattle Ranches, 1969; Hon: GSD,
PKD, AZ, ODE.

BROKKEN, Ray F. Dept. of Agr. Econ. OR
State Univ. Corvallis OR 97331; PH752-4208;
Agr. Econ; G-1; b. IA 1933; M-3; B.S. IA
State Univ. 1958; PhD IA State Univ 1965;
Fields: Farm Mgmt. & Prod. Econ. F; Res:
Econ. of Livestock Prod; Mem: WAEA, ASAS;
Agr. Econ USDA 69-71; Agr. Econ. ERS USDA
60-69; Hon: GSD, PKD.

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Univ. of WI, Madison WI 53706; PH 262-
3563; Asst. Prof; A-2,1; b. AZ 1940;
M-2; B.S. UT State Univ. 1963; M.S.
OR State Univ. 1967; PhD OR State Univ.
1969; Fields: Land & Water Econ. Cons.
& Devl. KLG; Res: Devl. of Methodology
for Wal. of Public Intervention in Hu-
man & Natural Res; Lang: Sp. 2,2,2; Mem:
IAAE, AEA, WAEA; Res. Fellow, OR State
Univ. 1969; Res. Asst. OR State Univ. 65-
67; Range Mgr. Bur. of Land Mgmt. 63-65;
Pub: Public Water Resource Proj. Planning
& Evaluation, 1971; Procedures for Eval.
of Water & Land Res. Project, 1970; The
Use of Discriminant Anal. in Selecting
Rur. Devl. Strategies, 1971.

BRONZI, Piero, c/o the Ford Found. 60 Ave.
Mohamed V., Tunis Tunisia; PH 283-422;
Agr. Prog. Adv; B-5; A-1; b. Italy 1932;
M-2; Doctor of Agronomy Univ. of Bari
1958; M.S. Univ. of IL 1966; Fields: Econ.
Devl. AF; Res: 2nd Generation Problems
of the Green Revolution; Lang: Fr. 1,1,1;
Eng. 1,2,2; Mem: IAAE, SIA, AEA; Prof.

Agronomio Mediterranean Inst. 66-70; Expert Mekong River Project, FAO 63-64; Pub: Agr. Devl. Characteristics & Planning, 1966; Changes in Property Size in St. Gilles: A Mark of Chain Anal. 1968; Social Acctg. & Planning, 1969.

BROOKE, Donald L. 1084 McCarty Hall Univ. of Florida, Gainesville FL 32601; PH 392-1845; Agr. Econ; A-1,4; b. NE 1915; M-2; B.S. Univ. of FL 1940; M.S. Univ. of FL 1942; PhD Univ. of FL 1954; Fields: Farm Mgmt. & Prod. Econ. BCD; Res: Labor, Materials, Costs & Return from Vegetable Crops in FL. Index of FL Farm Prices; Dir: 5; Ext. Econ. Univ. of FL 1946; Jr. Farm Cr. Adm. 41-42; Pub: Labor & Material Req. for FL Veg. Crops, 1963; Mkt. Structure & Econ Anal. FL Sweet Corn, 1965; Hon: GSD, AZ, ODE, PGM.

BROOKER, John R. 1130 McCarty Hall, Univ. of FL. Gainesville FL 32601; PH 392-2341; Agr. Econ; G-1; b. FL 1939; M-2; B.S. Univ. of FL 1961; M.S. Univ. of FL 1963; Fields: Agr. Mktg. CAG; Res: An Inter-regional Activity Anal. for Southern Vegetables; Lang: Fr. 2,0,0; Mem: SAEA; Mktg. Spec. FL Dept. of Agr. 66-69; Pub: Comm. Freezing of Six Vegetable Crops: Econ. Anal. 1971; Factors Affecting the Investment Feasibility in Tomato Packing Houses 1971; Hon: GSD, AZ, ODE.

BROOKER, Marvin A. 2014 McCarty Hall, Univ. of Florida, Gainesville FL 32601; PH 392-2251; Dean, Emeritus Prof. & Head; A-4,5; b. FL 1903; M; B.S. Univ. of FL 1926; M.S. Univ. of FL 1927; PhD Cornell Univ. 1931; Fields: Agr. Fin. & Cr. AB; Dir: 1,5; Dean Univ. of FL 55-69; Prof. Univ. of FL 1947; Exec. Sec. Price Control Board 46-47; Dir. of Res. Farm Cr. Adm. 41-46.

BROOKS, Bruce L. 423 Mumford Hall, Univ. of IL, Urbana IL 61801; PH 333-2073; Prof; A-2,3,1; b. ID 1920; M; B.S. Univ. of ID 1943; M.S. Univ. of ID 1950; PhD Purdue Univ. 1959; Fields: Agr. Mktg. CKG; Res: Agr. Firm Business Mgmt. & Mktg; Lang: Urdu 0,0,3; Mem: AMA, WAEA; Dir: 5; Prof. of Agr. Econ. Univ. of IL 1969; Prof. of Agr. Econ. WA State Univ. 1956; Assoc. Prof. MT State Univ. 1950; Co. Ext. Agt. Univ. of ID 1946; Pub: The Pacific Northwest Wheat Mkt. & Future Trading, 1961; Hedging by PNW County Grain Elevators, 1967; Agr. Crops. 1971.

BROOKS, Robert C. Box 5576, Dept. of Econ. NC State Univ. Raleigh NC 27607; PH 755-2256; Ext. Assoc. Prof; A-3,2,5; b. NC 1931; M-; B.S. NC State Univ. 1956; M.S. NC State Univ. 1958; PhD Duke Univ. 1965;

Fields: Agr. Mktg. CLF; Lang: Fr. 3,3,3; Ger. 3,3,3; Ext. Asst. Prof NC State Univ. 1965-67; Ext. Instr. NC State Univ. 63-65; Res. Instr. NC State Univ. 58-62; Pub: Egg Breakage in Mktg. & Processing Eggs in NC 1970. Financial Ration Anal. of Broiler Producing & Processing Firms, 1970; An Econ. Anal of the Sale of Cotton Allotment Across Co. Lines in 1966 (pub) 1968.

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BROWN, Dean A. 1000 Merchandise Mart Plaza Chicago IL 60654; PH 644-4510; Dir; B-2; b. IA 1923; M-2; B.S. IA State Univ. 1948; M.S. IA State Univ. 1957; Fields: Farm Mgmt. & Prod. Econ; DFL; Ext. Econ. Univ. of NE 58-63; Area Econ. IA State Univ. 56-57; Agency Mgr. Farm Bureau Insurance 51-55.

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BROWN, Earl H. 205 Warren Hall, Cornell Univ. Ithaca NY 14850; PH 607-256-4597; Prof; A-2,1,3; b. IN 1931; M-3; B.S. Univ. of MN 1956; M.S. Univ. of MN 1957; PhD MI State Univ. 1962; Fields: Agr. Mktg. DI; Res: Fin. Mgmt. Grocery Warehousing; Lang: Ger. 3,0,0; Fr. 3,0,0; Mem: AAES, AMA, AAMA; Dir: 5; Asst. Prof. MI State Univ. 62-63; Pub: Operating Results of Food Chains, 1970; Operating Results of Self-Service Discount Dept. Stores, 1970.

BROWN, R. Edward Jr. Coop Ext. Service, Univ. of Ga., Athens GA 30601; PH 542-2434; Ext. Econ; A-3; b. NC 1935; M-1; B.S. NC State Univ. 1957; M.S. OK State Univ. 1962; PhD Purdue Univ. 1970; Fields: Farm Mgmt. and Prod. Econ. DCL; Lang: Fr. 2,0,0; Mem: ASFMRA, SAEA; Asst. Co. Agt. NC State Univ. 58-60; Pub: Farm Machinery Cost Anal. 1964.

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BROWN, Joseph D. Bur. of Bus. Res; Ball St. Univ. Muncie IN 47306; PH 258-6208; Dir; A-4,2,1; b. OH 1937; M-3; B.S. OH State Univ. M.S. OH State Univ. 1960; PhD OH State Univ. 1964; Fields: Statistics & Methodology; Res: Anal. of Census; Lang: Fr. 3,0,0; Mem: AMS, FDRS; Dir: 5; Asst. Prof. Univ. of GA 63-68; Pub: Effect of Health Scare on Consumer Demand 1969; GA Peach Producing Ind. An Anal. of Interchanging Competition 1967; Adoption and Purchasing of Agr. Chemicals 1968.

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BROWN, Loyd C. Agr. Div. Bur. of the Census, Suitland MD 20023; PH 440-7098; Stat; A-5, B-1,4; b. OK 1941; M-1; B.S. OK State Univ. 1963; M.S. OK State Univ. 1968; Fields: Econ. Devl. JAE; Lang: Span. 1,1,1.

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Econ. of Natural Resource Allocation & Use; Mem: WAEA, AEA; Systems Anal. Army 67-68; Assoc Prof. WA State Univ 64-69; Pub: Transforming Rur. Policies 1969; Willingness to Pay Consumer Surplus and Constant Marginal Utility of Income 1967; Productivity, Techn. & Employment 1965.

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and Mktg; Mem: SAEA, ASSCT; Assoc. Prof. TX A&M Univ. 48-54; Pub: Returns, Costs and Profits, Raw Sugar Mills, 1971; Returns, Costs & Profits, Large Scale Farms, 1971; Returns, Costs & Profits, Family Type Farms, 1971.

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WAEA, SAEA, ASA, AAAS, PSA, AFA; Security Anal. Mercantile - Safe Deposit & Trust Co. 1950-58; Prod. Mgr. Swift & Co. 1943-1949.

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ization: (2) Field Crops (3) Sheep, Hog & Beef Prod, (10) Capital & Labor Requirements for Farming and (14) Summary Report: Implications, Issues and Challenges for the People of NY State 1970; Evaluating Proposed Capital Investments with Discounted Cash Flow Methods 1969; The Effect of Level of Mechanization Farm Org. and Income 1969.

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M.S. Univ of KY 1971; Fields: Econ. Devl LFG; Res: Four Systems Plng. Model of the Nigerian Cocoa Econ; Lang: Eng. 1,1,1; Chi 1,1,1; Mal 1,1,1; Sp. 2,2,2; Mem: SID; Grad. Res. Asst. Univ of KY 1966-68.

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Fruits & Vegetables 1959; Cost & Returns of Growing & Mktg. Pink & Green Wrap Tomatoes 1958.

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CORDREY, John B. Wright State Univ. Dayton OH 45431; PH 426-6650-468; Asst. Prof; A-1,2; b. OH 1939; M-3; B.S. OH State Univ. 1961; M.S. OH State Univ. 1962; PhD NC State Univ. 1969; Fields: World Agr. Prod. & Trade, GH; Res: Evaluation of Four Criminal Justice Programs Initiated by the Dayton Police Dept; Mem: AEA.

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vey of Livestock Mktg. Situation in the Near East; Lang: Ara. 1,1,1; Eng. 1,1,1; Fr. 1,1,1; Mem: IAAE, ISHS; Chief, Agr. Econ. Dept. Ministry of Agr. 59-70; Pub: Incentives for Traditional Agr: The Middle East as an Example 1967; Livestock Mktg. Situation Sudan 1971.

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CRELL, Bobby Joe, NM State Univ. Box 3169; Las Cruces NM 88001; PH 505-646-1819; Res. Assoc; A-2; b. NM 1943; M-3; B.S. NM State Univ 1968; M.S. NM State Univ 1971; Fields: Land & Water Econ. Cons. & Devl. AHL; Res: An Anal Interdisciplinary Eval. of the Water Resources of the Rio Grande Basin, NM; Mem: WAEA, AWRA; Agr. Mktg. Spec. Trainee, FHA, USDA 1967; Pub: Econ. Land Class-Pecos River Basin 1970; Opt. Water Requirement for Crops, Roswell 1969; Water Requirements for Crops, Roswell Basin 1969; Hon: AZ.

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CRITHARAS, C.P. 28 Stouznaza Street, Athens, Greece 103; PH 231256; Dep Dir. B-3,2,1; G-1; b. Greece 1912; M-0; MEBS Athens Univ 1944; Fields: Agr. Fin. & Cr. FBL; Lang: Eng. 1,1,1; Fr. 2,2,3; Accountant, Union Farmers Coop 1930-35.

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Land & Water Econ. Cons. & Devl. LHA; Res: Econ. of Property Rights; Lang: Fr. 2,3,0; Mem: AEA, APQA; Asst. Prof. Univ. of WI, 1964-70; Pub: Environmental Econ. (Co-author) 1971.

CROCKETT, Samuel L. USDA-FAS, Washington DC 20025; PH 388-4936; Chf. Econ. Anal. Br. & P&P Div; G-4,1,5; b. MS 1914; M-3; B.S. MS State Univ. 1936; M.S. MS State Univ. 1947; Fields: World Agr. Prod. & Trade, DK; Lang: Sp. 2,0,2; Mem: SAEA; ESS-3 Dept of State (ICA) 1955-57; Agr. Econ. BAE-USDA 1940-50.

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CROMARTY, William A. 45 Cardinal Drive, Westfield NJ 07091; PH 201-233-0700; V. Pres; B-5,4,2; b. Canada 1926; M-5; B.S. Univ. of Toronto 1951; M.S. MI State Univ 1953; PhD MI State Univ. 1957; Fields: Economet. CFJ; Lang: Fr. 2,3,3; Asst. Prof. MI State Univ. 1955-60.

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NY; Agr. Econ; G-4; b. NY 1937; M-0; B.S. Cornell Univ 1952; M.S. OK State Univ 1971; Fields: Land & Water Econ Cons & Devl; Res: Econ Impact of Environmental Quality Legislation on Confined Animal Feeding Operations in OK; Mem: SAEA; Res. Asst. OK State Univ. 1970-71; Agr. Econ. USDA 1967-69.

CROSSMON, Bradford D. Dept of Agr. & Food Econ. 235 Draper Hall, Univ of MA, Amherst MA 01002; PH 545-2490; Prof; A-3, 2,1; b. CT 1914; M-4; B.S. Univ of CT 1937; M.S. Univ of CT 1943; M of Pub Adm. Harvard Univ. 1949; PhD Harvard Univ 1963; Fields: Farm Mgmt & Prod Econ, BKJ; Res. Extending Unemployment Insurance to Agr. Workers; Lang: Sp. 2,3,2; Mem: AEA, NEAEC, NEFMC; Dir: 5; Visiting Prof. Univ of Puerto Rico 1966-66 & 1970; Assoc Prof. Univ of MA 1948-56; Res. Proj Ldr. Harvard Univ 1951-52; Chf. Mgmt. Spec FHA 1945-47; Asst. Prof. Univ of CT 1937-45; Instr. Univ of RI 1938-39; Pub: On Job Graduate Study in Agr. Econ. 1961; Mgmt. Alternatives for Mkt Egg Farms in MA 1964; Prod. Adjustment MA Tobacco Farms 1963.

CROSSWHITE, Wm. M. 6 Patterson Hall, NC State Univ. Raleigh NC 27607; PH 919-755-2607; Assoc Prof; G-2,1, A-1; b. PA 1930; M-3; B.S. Berea College 1953; M.S. MI ST. Univ. 1957; PhD MI State Univ. 1960; Fields: Land & Water Econ. Cons. & Devl. KA; Res: Water & Waste Mgmt. in Poultry Processing; Lang: Fr. 2,0,0; Mem: SAEA, CDS, SCSA; Dir: 5; Prof. Univ of DE 60-67; Grad. Asst. MI State Univ. 55-60; Pub: Implementation of Pollution Control by Food Processors, 1971; Fed. Domestic Assistance Programs & State Land Policy Devl. 1970; Waste & Waste Mgmt. in Poultry Processing 1971.

CROUCH, Robert M. Co. Ext. Agt. Alexandria KY 41001; PH 606-635-3116; Co. Agt. Agent; A-3; b. KY 1926; M-1; B.S. Univ of KY 1949; M.S. Univ of KY 1959; Fields: Land Mgmt. & Farm Prod. FBC; Lang: Sp. 3,3,3; Mem: NACA, NACEA, KACA.

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Univ of MO 1943; M.S. Univ of MO 1955; PhD
Univ of MO 1966; Fields: Farm Mgmt. &
Prod. Econ DEF; Lang: Sp. 2,3,0, Ger. 3,
0,0; Mem: ASFMRA.

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M.S. MT State Univ. 1967; Fields: Land &
Water Econ. Cons. & Devl. D; Res: Farm
Land Prices; Mem: ASFMRA, OSFMRA; Hon: AZ,
PKP.

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Univ. Ames IA 50010; PH 294-8218; Res Assoc;
A-2; b. Canada 1940; M-1; B.A. Queens Univ.
1963; M.S. Univ of Guelph 1968; Fields:
Econ Devl. FHL; Res: Income Distr. Aspects
of Econ. Devl. & Devl. Policy; Cons. Econ.
Acres Limited 68-69.

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Student; A-5,2,1; b. TN 1946; M-0; B.S.
Univ. of TN 1968; Fields: Agr. Fin & Cr.
KHJ; Res: Derivation of Prod. Functions
for Cotton; Trainee-SRS Ga. Crop Report-
ing Service 1967.

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206E, GHI Bldg. Washington DC 20250; PH
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State Univ. 1962; PhD Univ of MN 1969;
Fields: Farm Mgmt. & Prod Econ. GHL;
Res: Assess Econ. Impact of Selected Vari-
ables; Lang: Fr. 2,2,2; Latin 2,2,2; Stud.
OH State Univ. 1956-1962; Pub: Effects of
Urban Expansion on Dairying in the Lake
States 1949-69 (pub. 1970); Resources Use
and Returns for Grade "A" Dairy Farms 1968-
69 (pub. 1971); Dairy Farm Costs & Returns
1963-65 & 1968; Hon: GSD.

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PH 512-972-2577; Co. Mgr; B-2,1,3; b. TX
1937; M-2; B.S. Univ. of Houston 1961;
Fields: Farm Mgmt. & Prod. Econ. BJD.

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3010; Emer. Prof; b. IL 1903; M-3; B.S.
Univ. of IL 1926; M.S. Univ of IL 1927;
PhD Cornell Univ 1934; Mem: AES, IAAE;
Prof. Cornell Univ. 1942-69; Assoc. Prof
Cornell Univ. 1940-42; Asst. Prof. Cor-
nell Univ. 1934-40; Pub: Farm Mgmt. &
Mkt. 1942; Commercial Dairy Farming in
NY 1965; Hon: AZ, PKP, SX, GSD.

CURTIS, John M. Univ of MD, College Park,
MD 20742; PH 454-3802; Prof. & Head of
Dept; A-4,3,1; b. NC; M-3; B.S. NC
State Univ 1947; M.S. NC State Univ. 1950;
PhD Univ of MA 1960; Fields: Agr. Mktg.
FKE; Res: Area of Communications; Fr. 3,0,0;
Ger. 3,0,0; Mem: SAEA, NECEA, AAAS; Dir: 5;
Assoc. Prof NC State Univ 1951-61; Assoc.
Prof. 1950-51; Pub: Advisory Work in Agr.
Mktg. 1965; Hon: PKP, PBS, AKD.

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State Univ. University Park PA 16801; PH
865-6581; Asst. Prof; A-1,2; b. PA 1932;
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Univ. 1958; PhD Penn State Univ. 1967;
Fields: Farm Mgmt. & Prod. Econ. DFE; Res:
Use of Simulation in Teaching Agr. Classes;
Dir: 3; Teacher, Middlebury High School,
PA 1954-64; Pub: In-Services Educ. 1971;
Cost-Benefit Anal. 1970; Effectiveness of
Simulation in Teaching 1968; Hon: PKP, DDK,
GSD.

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B.S. Auburn Univ. 1961; M.S. Auburn Univ.
1963; PhD MS State Univ. 1971; Fields: Gen.
Econ. Theory, EGL; Res: Rural Devl. & the
Quality of Life in the Rural South; Lang:
Ger. 2,3,0; Mem: AEA, ASA; Instr. MS State
Univ. 1969-71; Grad. Res. Asst. MS State
Univ. 1968-69; Instr. Troy State Univ. 1967-
68; Hon: PKP, GSD, ODE, AZ.

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ton, NY 10533; PH 591-7230; Exec. Secy; B-
5; A-2,4; b. IL 1904; M-3; B.S. Univ. of IL
1927; PhD Cornell Univ. 1936; Fields: Gen
Econ. Theory, IK; Mem: AEA; Dir: 2,5; Prof.
Cornell Univ. 1932-46; Farmer, IL 1927-32;
Hon: AZ, SX.

CUSKADEN, Charles M. Dept of Agr. Econ. Univ
of Tennessee, Knoxville TN 37916; PH 974-
7231; Asst. Prof; A-2,1; b. IN 1937; M-2;

B.S. Purdue Univ. 1961; M.S. Univ of KY 1963; PhD MI State Univ 1971; Fields: Farm Mgmt. & Prod. Econ. DFG; Res: Evaluation of Beef Prod. Ind. in the South; Lang: Sp. 2, 3,3; Mem: SAEA, Tn. SFMRA; Asst. Prof. W. TX State Univ. 1967-68; Pub: Minimum Farm Sizes for Given Income Levels in Two KY Bluegrass Areas, 1971.

CUSUMANO, Vincent, Dept of Agr. Econ. Univ. of KY, Lexington KY 40506; PH 606-257-4788; Res. Assoc; A-2,1,3; b. Italy 1943; M-2; B.S. Bradley Univ. 1966; M.A. Univ. of KY 1966; Fields: Econ. Devl BHD; Res: Econ. Devl. Potential; Lang: Sp. 1,1,1; Ita. 2, 3,2; Fr. 2,0,0; Mem: SID; Teaching Asst. Univ of KY 1969-70; Coop. Agt. Chile, 1966-69; Hon: ODE.

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CUYKENDALL, Charles H. Dept of Agr. & Appl. Econ. 312 Coffey Hall, Univ of MN, St. Paul MN 55101; PH 612-373-1145; Ext. Econ; A-3, 2,1; b. NY 1940; M-1; B.S. Cornell Univ. 1962; M.S. Univ of MN 1965; PhD Univ of MN 1967; Fields: Farm Mgmt. & Prod. Econ. BDE; Res: Evaluation of Cropping Systems & New Technology; Lang: Fr. 2,3,3; Res. Asst. Univ of MN 1962-65; Pub: Defoliation by Sheep; Grazing vs. Mower Clipping for Evaluation of Pasture 1968; Performance of Berseem Clover 1965; Hon: GSD, SX.

DABASI-SCHWENG, Lorand, Sous-la-Roche, 1181 Mont-sur Rolle, Vaud, Switzerland; PH 021-75-1836; Cons; G-1; b. Hungary 1905; M-0; B.S. Palatine Joseph 1928; M.S. Univ. of Budapest 1928; PhD Univ. of Budapest 1940; Fields: Farm Mgmt. & Prod. Econ. EDF; Res: The Econ. of Subsistence Agr; Problems of Technical Assistance in Improving Subsistence Agr; Lang: Hun. 1,1,1; Eng. 1,1,1; Ger. 1,1,1; Fr. 1,2,1; Sp. 1,2,1; Mem:

AEA; Cons. FAO 1970-71; Chf. of Party. IDS 1969-70; Tech. Officer FAO 1967-69; Pub: The Problems of Transforming Traditional Agr. 1965; Improving Small Family Farms, 1965; La Produccion del Maiz en Guatemala, 1960.

DADD, Christopher M. Dept of Agr. Econ. Univ of Wisconsin, Madison WI 262-3053; PH 262-3053; Res. Asst; A-2; b. England 1944; U; B.S. Univ of Nottingham, 1967; M.S. Univ of WI 1969; Fields: Stat. & Meth. BKF; Res: Consumption Anal. in Brazil; Lang: Por. 2,2,2.

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DANNER, Maurice J. Dept of Agr. Econ. Auburn Univ. Auburn AL 36830; PH 205-826-4800; Prof; A-2,1; b. OK 1917; M-3; B.S. TX Tech. 1941; M.S. Univ of TN 1942; Fields: Agr. Mktg; Res: Econ. Evaluation of Alternative forms of Vertical Coordination in the Livestock-Meat Ind; Mem: SAEA; Dir: 5; Grad. Asst. TX Tech; Grad. Asst. Univ. of TN.

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Univ. 1959; ME NC State Univ. 1969; Fields: Agr. Policy, J; Res: Impact on Agr. of UK, Membership of EEC; Lang: Fr. 2,0,3; Mem: IAEA, AEA; Agr. Econ. Ministry of Agr. 1961-66; Pub: Micro Econ. Approval and the Anal. of Supply Resources in UK Agr. 1971; Farming Systems in the Common Mkt. 1969; Econ. Aspects of Coop. Grain Drying, Storage & Mktg. 1968.

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Continental U.S.; Lang: Sp. 2,2,2; Ger. 3, 3,0; Mem: SEA; Agr. Econ. FPED ERS USDA 1962-69; Grad Teaching Asst. TX A&M 1961-62; Pub: Alt. Tobacco Harv. & Curing System for NC Coastal Plains, 1969; Econ. of Size on Irr. Cotton Farms, TX High Plains 1965; Theory & Procedures for Studying Econ. Size on Irr. Farms, 1965; Hon: PKP.

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Fr. 1,1,1; Eng. 1,1,1; Mem: IAAE, AEA,
CAES, CEA; Res. Dir. Brd. Broadcast, Govern-
ors 1960-64; Sec. Royal Comm. on Price &
Spreads of Food Prod. 1958-60; Res. Assoc.
Univ. of Chicago 1955-57; Pub: Productiv-
ity Change in Canadian Mining Industries
1971; Implementing A Sound Policy for Can-
adian Agr. 1970; Changes in Agr. to 1970,
pub (1964).

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Econ. USDA 1965-67; Chf. USDA 1964-64;
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Agrarie Napoli 1961; Fields: Farm Mgmt. &
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1,4; b. IA 1930; M-3; B.S. IA State Univ
1952; M.S. IA State Univ 1955; PhD IA State
Univ 1957; Fields: Farm Mgmt. & Prod. Econ.
KEF; Res: Reg. Devl. in North Coast of CA;
Lang: Ita. 1,2,2; Mem: WAEA, AEA; Asst.
Prof. Univ of CA 1958-61; Pub: Decisions
Under Uncertainty 1971; Reg. Resource Use
for Agr. Prod. in CA 1970.

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Bank of Georgia, Atlanta, GA; A-2; b. OH
1944; M-0; B.A. OH Univ. 1967; M.S. Univ
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Peanut Proj. S.W. Georgia; Lang: Greek 1,1,
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Univ of GA 1970-71; Hon: GSD, ESP.

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M.S. Univ of WI 1970; Fields: Econ. Devl.
JEF; Res: Private Benefits & Costs of
Rur. to Urban Migration; Lang: Sp. 2,2,2;
Th. 3,3,1; Mem: ODK, AZ; Pro. Econ. Robert
Kennedy Memorial 70-71; Teaching Asst.
Univ of WI 1969; Res. Asst. Univ of KY
1966-68; Peace Corp 1962-64; Pub: Types of
Miao Hill Rice 1969; Green Miao Agr. Terms,
1969; A New Plan, Rur. Poverty and the
Urban Centers 1971.

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Univ 1955; PhD IA State Univ 1957; Fields:
Farm Mgmt. & Prod. Econ. FGL; Res: A Text-
book on Prod. Theory and Analytical Methods
at the Intermediate Level; Lang: Fr. 1,2,2;
Port. 1,3,2; Eng. 1,1,1; Mem: AEA, ES, SIEA;
Asst. Prof. Univ of Naples 1960-68; Econ.
FAO 1958-59; Pub: Irrigazione e Ordinamenti
1965; La Valitazione dell' Efficienza
Aziendale 1961.

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Asst; A-2; b. ND 1947; U; B.S. ND State
Univ 1969; M.S. ND State Univ 1970; Fields:
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A-2; b. OR 1944; M-2; B.A. CO State Univ.
1966;; Fields: World Agr. Prod. & Trade,
KAF; Res: Village Livestock Prod. Systems
in Thailand; Lang: Thai 2,2,2; Lao, 0,0,3;
Sp. 2,2,2; Farm Mgmt. Supvr. FHA USDA 1964-
65; Pub: Factors Affecting Livestock Output
in Thailand, 1971; The MN Mink Ind. 1969;
Hon: AZ, NDEA.

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Science Economiques Lovvain 1964; Certificate
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Gen. Econ. Theory, GFB; Res: Mktg. Boards; Lang: Eng. 1,1,1; Ger. 1,2,2; Dutch 1,2,2; Act. Asst. Prof. Fac. Univ. Cath. Mons. 1968-70; Res. Asst. Univ. of Cath. Lovvain, 1966-67; Pub: Analyse Economique Des Investissements Dans L'Agriculture Belge 1968.

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Mem: SAEA, FDRS; Assoc. Co. Agent, TX Agr. Ext. Ser. 1965-67; Pub: Impact of Price Specials on Estimates of Retail Meat Prices 1970; Hon: GSD, ODE.

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1947; M.S. Cornell Univ. 1948; PhD Univ. of MN 1957; Fields: Gen. Econ. Theory, JFK; Res: Changing Agr. Patterns in Appalachian Regions; Mem: NACTA, AEA; Hon: SX.

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MED ERS USDA 1957-67; Pub: Interregional Competition in the Cattle Feeding Econ. 1971; Cost & Econ. of Size in TX-OK Cattle Feeding Operations 1969; An Interregional Anal of the Fed. Beef Econ. 1966.

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Latin Am; Lang: Sp. 1,1,1; Fr. 2,3,3; Port. 2,0,0; Mem: AEA; Dir: 2,5; Reg. Officer, FAO of U.N. 1964-68; Econ. USDA 1961-62; Prof. Univ of RI 1955-61; Pub: Agrarian Structure in Seven Latin Am. Countries, 1966; Land Tenure Conditions & Socio. Econ. Dev. of the Agr. Sector in Argentina 1966; Role of Agr. Taxation in Financing Agr. Devl. in Latin Am. 1971.

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Soybeans for Feed, 1965; Synthetic & Subs. for Oilseeds Prod. 1969; Potential Mkts. for Safflower 1971.

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Univ. 1962; M.A. WA State Univ. 1966; PhD Stanford Univ. 1971; Fields: Econ. Devl. A, EF; Res: Econ. Implication on Agr. Mechanization in Tropical Asia; Lang: Pun. 0,0,2; Mem: ASAE, AEA, WAEA; Asst. Agr. Econ. IRRI 197-- --; Res. Asst., Stanford Univ. 1968-69; Agr. Econ. USDA 1965-66; Pub: Quant. Impact of Green Rev. in West Pakistan 1970; Mech. of Green Pea Ind. in Washington-Oregon, 1967.

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Shopping Habits & Attitudes of Cons. in Portland, Maine 1967; Devl. & Mktg. of New Food Prod. 1966.

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for Vegetables, 1970; A Decade of Change Prices & Spread, 1970.

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1957-66; Pub: Extent of Farm Pesticide Use 1968; Anal. of PA Farm Bur. Coop. 1966.

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Their Effectiveness; Lang: Fr. 3,0,0; Ger. 3,0,0; Mem: AEA; Mktg. Anal. Safeway Stores, 1945-48; Mktg. Anal. Moore Bus. Forums, Inc. 1942-44; Mktg. Anal. Nulaid Egg Coop. 1939-41; Pub: Expanding the Mkt. for CA Avocados 1963; Broadening the Mkt for Artichokes, 1966.

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The W. German Grain Econ. and the Common Mkt. 1966; The Problem Multiplying Effects of Spec. Wheat Programs, 1961.

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lems of Concern to Growers in the Macon Ridge & Upper MS River Delta Areas of LA; Lang: Fr. 2,0,2; Mem: AEC; Instr. AK State Univ. 1968-69; Pub: A Comparative Anal. of LA Broiler Contracts, 1970; Sweet Potato Storage: Model Facilities Storage, Costs, and Data for Auxiliary Packing Operations, 1971; Costs, Returns & Pay-Out of Retail Gasoline Operations Within LA Farm Supply Stores, 1971; Hon: GSD.

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Villanova Univ 1961-63; Asst. Prof.
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Market Continuously, 1969.

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With Fresh Winter Produce: Capabilities
of U.S. & Mexican Prod. Areas; Lang:
Sp. 3,0,0; Mem: NEAEC; Asst. Agr. Econ.
ME Agr. Exp Sta. 1953-56; Pub: Potential
Mechanization in the Flue-Cured Tobacco
Ind. with Emphasis on Human Resources,
1969; Supplying U.S. Mkts. with Fresh
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Ger. 3,0,0; Fr. 3,0,0; Mem: SAEA, WAEA;
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Prospects, 1966; Pricing Eggs at Wholesale
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Forward Integration by Coop; Mem: SAEA, WAEA, RSA; Dir: 5; Prof. TX A&M Univ. 1966-71; Proj. Ldr. Natl. Commn. on Food Mktg. 1965-66; Pub: The Southern Rice Ind. 1970; Mkt. Power for Agr. in S.W. 1968; Exp. Pricing Approach to Demand Anal. 1958.

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GOLOSI, Lloyd F. National Stat. Office, Box 333, Zomba, Malawi, Africa; Prof. Officer (Stat); G-3; b. Malawi 1944; U; B.S. IA State Univ 1971; Fields: Gen. Econ. Theory, GKB; Eng. 1,1,1; Mem: ASA.

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Structure & Performance in the Florist Ind.
Lang: Sp. 3,0,0; Mem: ASHS; Assoc. Prof;
Cornell Univ. 1964-70; Asst. Prof. Cornell
Univ. 1958-64.

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Panhandle A&M Univ; M.S. OK State Univ.
1959; PhD OK State Univ. 1962; Fields:
Agr. Mktg. CLK; Res: Interregional Com-
petition in the Beef Ind; Price Econ.
Armour & Co. 1961-64; Hon: AZ.

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Univ. 1967; Fields: Land & Water Econ.
Cons. & Devl, KLF; Res: Marine Econ.
Environ. Econ. Outdoor Recreation; Lang:
Eng. 1,1,1; Hindi 2,2,2; Mem: AWRA; Asst.
Prof. MT State Univ. 1967-69; Teaching
Asst. MT State Univ. 1963-66; Sr. Res.
The Econ. Times, 1961-63; Res. Natl. Coun-
cil of Applied Econ. Res. 1958-61; Pub:
Aspects of Water Resource Devl. 1971;
Water Transfer & Econ. Devl. 1968; Econ.
Principle of Res. Allocation, 1967.

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of Planning, DAR Es Salaam, Tanzania;
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B.A. Univ of Manitoba 1960; M.A. Univ of
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Res: Control Systems for Natl. Budgets
in Developing Countries; Lang: Fr. 1,1,1;
Sp. 2,2,3; Swa, 3,3,3; Prin. Econ. Mins.
of Econ. Affairs, 1966-68; Pub: Model for
Estimating Agr. Acreage & Prod. in Malawi,
1971.

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43324; PH 542-6010; Acct; B-1; b. OH 1935;
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and Water Econ. Cons. & Devl, KL; Res:
Community Resource Devl; Mem: AEA; Res.
Assoc. Univ of WI 1970-71; Agr. Econ.
NRED-ERS-USDA 1967-70.

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Carty Hall, Univ. of Florida, Gaines-
ville FL 32601; PH 392-1886; Res: Econ.
Evaluation of Expanded Nutrition Program
in FL; Lang: Chinyanja 2,2,2; Hon: ODE.

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1962; Fields: Agr. Mktg. KA; Res: Improve-
ment of Employment Opportunities & Earn-
ings for Disadvantage People in Non-
Metropolitan Areas; Lang: Sp. 3,3,3; Mem:
IAAE, WAEA; Agr. Econ. Stanford Res. Inst.
1967-69; Asst. Prof. Purdue Univ. 1962-
67; Res. Fellow, OR State Univ. 1960-62;
Pub: Cost & Return Budgets for Selected
Crop Enterprises for 320-640 and 1280
Acre Farm Sizes in Northwestern NM; Cost
Return & Investment Budgets for Selected
Crop Enterprises for Corporate Structured
Farms in Northwestern NM; Econ. Potential
of Backgrounding Feeder Calves in South-
eastern NM; Hon: PKP.

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Cambridge Univ. 1955; M.A. Cantonage
Univ. 1959; M.S. Univ of Toronto 1962;
PhD Univ. of IL 1965; Fields: Gen. Econ.
Theory, HK; Res: Res. In Input-Output &
Related Econ. Models; Lang: Fr. 1,1,1;
Ger. 1,2,3; Mem: ES, AAES, UTE; Res.
Fellow, Manchester Univ. 1966-69; Res.
Assoc. Univ of IL 1965-66; Pub: Input-
Output in the United Kingdom 1970; A
Note on User Cost, 1969; The Existence,
Uniqueness & Stability of the Standard
System, 1967; Hon: SX.

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Res. Assoc; A-2,1; b. IA 1943; M-1; B.S.
Univ. of ID 1968; M.S. Univ of AZ 1970;
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Lang: Sp. 1,1,1; Mem: WAEA; Hon: AZ.

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Land & Water Econ. Cons. & Dev. AFK; Res:
Prod. of Trades & Amphity; Res. Forester,
USFS, 1961

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0,0; Mem: WAEA, OPEDA; Agr. Econ. NRED ERS USDA 1964-70; Agr. Econ FPED ERS USDA 1962-64; Pub: Agr. & Food Processing, PNW 1966; Econ. Base & Projections CNP 1970; Ind. Devl. & Nonfarm Employment, 1958; Hon: SGD.

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WAEA; Sec. WAERA - Rec. Sec. WAAESD & Agr. Econ. ERS USDA 1965-70; Agr. Econ. ERS USDA 1954-65; Teaching Asst. Univ of MA 1953-54; Hon: GSD.

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Econ. & Org. of Merging Coop; Mem: ACE; Dairy Project Ldr. Natl. Comm. on Food Mktg. 1965-66; Pub: Cooperative Communications-Techniques 1971; Cooperative Communications - Bibliography 1970; Cooperative Communications - Ideas that Work, 1970.

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Pub: Profit Planning & Control: A Computer Oriented System for Farm Ind. Mgmt, 1969.

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HARVEY, William E. FEDS-USDA, Washington, DC 20250; PH DU8-4773; Dir. for Trng. Div; G-5,6; b. VA 1913; M-1; B.S. Va. Poly Tech. 1935; MPA Harvard Univ. 1950; DPA Harvard Univ. 1953; Fields: Econ. Devl. F; Lang: Sp. 3,3,3; Mem: SID; Dir: 5; Asst. Div. Dir. USDA 1954-64; Program Spec. USDA 1951-54; Hon: ESP.

HARVELLE, Richard L. FPED ERS USDA, Agr. Econ. Dept. OK State Univ. Stillwater, OK 74074; PH 372-6211; Agr. Econ; G-1; b. U.S. 1929; M-3; BBA Univ of TX 1951; M.S. TX A&M Univ. 1970; Fields: Agr. Policy, AK;

Res: Natl. Model Projections for 1972: Optimum Overplant for Protection of Cotton Payment Yield; Lang: Sp. 2,2,2; Mem: SAEA, WAEA; Self-employed Farmer 1955-68; Pub: Selected South Central U.S. Crop Budgets, 1971; Is Crop-Share Lease Insufficient? 1970.

HARWOOD, Dewey G. 18 Patterson Hall, NC State Univ. Raleigh NC 27607; PH 755-2611; Ext. Assoc. Prof; A-3; b. NC 1928; M-5; B.S. NC State Univ. 1951; M.S. NC State Univ. 1958; Fields: Farm Mgmt. & Prod. Econ; Res: Econ. Feasibility of Various Prod. Practices; Lang: Fr. 3,0,0; Ger. 3,0,0; Mem: NESFM, ASFM; Asst. Co. Agent NC Agr. Ext. Service, 1952-55; Farmer, Self Employed 1960-63; Pub: Estate Plng. for NC Farm Families, 1970; Egg Breaking in Mktg. Eggs, 1970.

HASAN, Mohammed Ali, Pagla PO Rupsi, TTO Phulpur, Mymensingh, East Pakistan.

HASBARGEN, Paul R. Agr. Econ. Dept. Univ of MN, St. Paul MN 55108; PH 373-1145; Prof; A-3,2; b. MN 1929; M-2; B.S. Univ of MN 1952; M.S. Univ of MN 1956; PhD MI State Univ. 1967; Fields: Farm Mgmt. & Prod. Econ. CD; Res: Improving the Competitive Position of the Northern Corn Belt Beef Ind; Lang: Sp. 3,0,0; Ger. 0, 0,3; Mem: FMRA; Dir: 5; Pub: Competition Position of Cattle Feeding in the Northern Cornbelt, 1968.

HASH, Charles T. Commerce Department, MT State Univ. Bozeman MT 59715.

HASKELL, James E. Farmer Coop Service USDA, Washington DC 20250; PH 963-4113; Agr. Econ; G-1,4; b. NE 1942; M-2; B.S. NE Univ. 1964; M.S. NE Univ. 1965; PhD KS State Univ. 1970; Fields: Agr. Mktg. LGH; Res: Integrated Cotton Mktg. Systems; Res. Asst. KS State Univ. 1968-70; Asst. SD State Univ. 1965; Res. Asst. Univ. of NE 1964; Pub: Results & Methods of Coop. Mergers 1970; Econ. of Plant Size in Floor Milling 1969; How Many & How Big, 1971; Hon: ODE, GSD.

HASLETT, Earl A. Ontario Dept of Agr. & Food, Parliament Bldgs. Toronto, Ontario Canada; PH 365-1064; Dir: G-5,4,1; b. Canada 1926; M-4; B.S. Guelph Univ. 1949; M.S.A. Toronto Univ. 1953; PhD Toronto Univ. 1964; Fields: Agr. Policy, B; Lang: Fr. 3,0,0; Mem: CAES, AIC; Assoc. Dir. Farm Econ. 1965-68; Econ. Farm Econ. 1949-65; Pub: Cheddar Cheese Factories in Ontario 1965; Mktg. Potatoes in Ontario, 1954; Distr. of Essex Co. Fresh Fruits & Vegetables 1957.

HASSAN, Zuhair A. Dept of Agr. Econ. Univ of Missouri, Columbia MO 65201; PH 449-9361; Grad. Asst; A-2; b. Palestine 1937; M-2; B.S. W. Pakistan Agr. Univ. 1964; M.S. Univ of MN 1966; Fields: Agr. Mktg. CH; Res: Estimation of Demand Parameters; Lang: Eng. 1,1,1; Mem: CAES; Pub: Use of Nonfat Dry Milk in the Prod. of Cheddar Cheese.

HASSLER, James B. Dept of Agr. Econ. Univ. of NE, Lincoln NE 68503; Prof; A-1,2; b. NE 1920; M-2; B.S. Univ of CA 1948; PhD Univ of CA 1952; Fields: Stat. & Meth. HBC; Res: USDA Data & Information System for Beef-Pork Sector; Lang: Fr. 2,0,0; Mem: ES, ASA; Dir: 5; Hon: SX.

HATCH, Ray E. Dept of Agr. Econ. OH St. Univ. Stillwater OK 74074; PH 405-372-6211/7521; Agr. Econ; G-1; b. TX 1939; M-2; B.S. TX Tech. 1961; M.S. TX A&M Univ. 1963; Fields: Farm Mgmt. & Prod. Econ. DF; Res: Firm Growth on Dryland Farms, Southern Great Plains; Mem: WAEA; Res. Asst. TX A&M Univ 1961-63; Hon: AZ, PKP.

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Univ of FL 1960; Fields: Agr. Mktg. C;
Mem: FSHS; Field Rep. Wilson & Comer Fer-
tilizer Co. 1960-62; Dealer, Wearever Alum.
Cooking Utensils Co. 1955-60; Hon: GSD, PKP,
AZ.

HAWKINS, Murray H. Dept of Agr. Econ.
Univ. of Alta, Edmonton, Alta, Canada;
PH 432-4034; Assoc. Prof; A-1,2,3; b.
Canada, 1930; M-2; B.S.A. Guelph Univ.
1953; M.S. Univ. of Alta, 1964; PhD OH
State Univ. 1967; Fields: Agr. Mktg. FJK;
Res: North American Pork Market; Lang: Fr.
2,0,0; Mem: AEA, WAEA, CAES; Dir: 5; Live-
stock Buyer, Canada Packers 1953-63; Pub:
A Study of the Montreal Wholesale Meat
Trade, 1970; Vertical Integration & Con-
centration in the Alta Broiler Ind. 1970;
An Emperical Study of the Metropolitan
Mkt. Conduct in Food Retailing, 1970.

HAWKINSON, Arthur E. Jr. 450 N. 30th St.
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Metropolitan Univ. Tokyo, Japan; PH
03-717-0111; Assoc. Prof; A-2,1; b.
Tokyo; M-3; B.A. Univ. of Tokyo 1956;
PhD IA State Univ. 1960; Fields: Econ.
Devl. LF; Res: Agr. Devl. in Japan &
Asia; Lang: Fr. 3,0,0; Eng. 1,1,1;
Assoc. Prof. Tokyo Metropolitan Univ. 1966-
--; Visiting Prof. Univ. of MN 1968-70;
Res. Fellow, Natl. Res. Inst. of Agr.
1956-66; Pub: Agr. Devl: An Intl. Per-
spective, 1971; Agr. Productivity Differ-
ences Among Countries, 1970; Factor Prices
& Tech. Changes in Agr. Devl. in the U.S.
and Japan, 1970.

HAYENGA, Marvin L. Dept of Agr. Econ. MI
State Univ. E Lansing MI 48823; PH 353-
7161; Asst. Prof; A-2,1,3; b. IL 1940;
M-2; B.S. Univ of IL 1962; M.S. Univ of
IL 1963; PhD Univ of CA 1967; Fields: Agr.
Mktg. FHK; Res: Simulating the Nigerian
Economy; Lang: Sp. 2,0,0; Mem: AEA, ES;
Post Grad. Res. Agr. Econ. Univ of CA '63-65.

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Lansing MI 48823; PH 353-7894; Res. Asst;
A-2, b-3; b. IL 1942; M-0; B.S. Univ. of
IL 1964; M.S. Univ of IL 1969; MBA MI State
Univ. 1971; Fields: Agr. Fin. & Cr. BAF;
Effects of Bank Mergers on Services Avail-

able From Country Banks; Res. Asst. Univ.
of IL 1964-65; Comm. State Bank 1965-66;
Hon: GSD, AZ, PES.

HAYHURST, France T. Canfarm Box 1024,
Guelph, Ontario, Canada; PH 821-8000;
Econ; G-4; b. England 1932; M-4; B.S.
Univ. of Alberta 1957; M.S. Univ. of
Toronto 1960; Fields: Farm Mgmt. D; Mem:
CIA, CAES, AEEA; Head, F.M. Ridgetown Coll.
1965-71; Pub: Plng. Father - Son Agree-
ments, 1966; Income Sharing Arrangements
1966.

HAYNES, Lawrence W. Dept of Econ. & Bus.
Bridgewater College, Bridgewater VA 22812;
PH 828-2501; Prof; A-1,4,2; b. U.S. 1914;
M-3; B.S. Purdue Univ. 1936; PhD Univ. of
WI 1957; Mem: AEA; Agr. Stat. USDA, 1946-
70.

HAYNES, Warren, Pac. Study Coop. P.O. Box
3588; Portland OR 97208; PH 503-235-8811;
Mkt. Res; B-4,1,3; b. OR 1922; M-2; B.S.
Univ of OR 1948; Fields: Stat. & Meth. AB;
Res: Investment Feasibility Study: Corn
Drying & Mktg; Lang: Sp. 2,2,3; Sales
Anal. Am. Cyanamid Co. 1956-68.

HAYTHORNE, George V. 2190 Alta Vista Dr.
Ottawa, Ontario, Canada K1H 7M1; PH
992-4889; Commissioner; G-6,1,2; b. Can.
1909; M-2; B.A. Univ. of Alta, 1930; M.A.
Univ of Alta 1932; PhD Harvard Univ. 1949;
Fields: Econ. Devl. FJA; Res: Income
Policies; Lang: Fr. 1,3,2; Ger. 3,0,0;
Mem: CAES, AEA; Dir: 1,5; Dep. Minister
Canada Dept of Labour, 1961-69; Asst.
Deputy Mins. Canada Dept of Labour, Dir.
Econ. & Res. Br., Can. Dept of Labour
1948-52; Pub: Land & Labour, 1941; Labour
in Canadian Agr. 1960.

HAZELL, Peter B. Dept of Agr. Econ. New-
castle Univ., Newcastle Upon Tyne, Eng-
land; Sr. Res. Assoc; A-2,1; b. England
1944; M-0; C.D.A., NDA, Seale-Hayne Agr.
Coll. 1964; C.D.F.M., Seale Hayne Agr.
Coll. 1965; M.S. Cornell Univ. 1968; PhD
Cornell Univ. 1970; Fields: Stat. & Meth.
AH; Res: Microecon. Supply Model of United
Kingdom Agr; Mem: AES, ES, IMS; Res. Teach.
Asst. Cornell Univ. 1965-70; Pub: Linear
Alternative to Quadratic Programming, 1971;
Obtaining Acceptable Farm Plans Under Un-
certainty, 1970; Game Theory-Ext. for Farm
Plng. 1970; Hon: PKP.

HEADLEY, Joseph C. 200 Mumford Hall, Univ
of MO, Columbia MO 65201; PH 314-449-9361;
Assoc. Prof; A-2,1; b. IL 1930; M-2; B.S.
Univ of IL 1952; M.S. Univ of IL 1955; PhD
Purdue Univ 1960; Fields: Land & Water
Econ. Cons. & Devl. A; Res: Agr. Tech. &

and Environmental Quality; Mem: AAAS; Dir: 5; Asst. Assoc. Prof. Univ of IL 1960-66; Assoc. Spec. Univ of CA 1959-60; Grad. Asst. Purdue Univ 1957-59; Pub: The Pesticide Problem, 1967; Impact of Irrigation on Farm Output Productivity of Agr. Pesticides, 1968; Hon: SX.

HEADY, Earl O. East Hall, Iowa State Univ. Ames IA 50010; PH 294-3133; Distinguished Prof; A-1,2,4; b. U.S. 1916; M-3; B.S. Univ of NE 1939; M.S. Univ of NE 1940; Univ of NE 1945; DS Univ of Upsalla 1965; DS Univ of NE 1960; Fields: Agr. Policy AKJ; Mem: FAAS, FASA, AE; Dir: 1,2,5; Dir. & Dist. Prof. IA State Univ. 1957- --; IA State Univ 1945-49; Pub: Econ. of Agr. Prod. & Resource Use, 1952; U. Programming Methods, 1958; Agr. Policy Under Econ. Devl. 1962; Studies in Agr. Policies, 1971; Econ. Models & Quantative Methods for Decisions & Ping. in Agr. 1971; Hon: GSD.

HEAGLER, Arthur M. FPED-ERS-USDA, Dept of Agr. Econ. & Agribusiness, LA State Univ. Baton Rouge LA 70803; PH 504-388-5314; Agr. Econ; G-1; b. AR 1930; M-2; B.S. Univ of AR 1955; M.S. Univ of AR 1956; Fields: Farm Mgmt. & Prod. Econ. FKL; Res: Econ. of Farm Org. & Size in the MS River Delta Area; Lang: Ger. 3,0,0; Mem: SAEA; Pub: The Place of Cow-Calf Enterprises in Farming Systems in the Yazoo-MS Delta, 1965; An Econ. Appraisal of Skiprow Cotton Planting in the Yazoo-MS Delta, 1964; Costs of Prod. Beef Gains With a High Energy Corn Silage - MS River Delta Area, 1967.

HEALEY, George E. New Holland Div. of Sperry Rand Corp. New Holland PA 17557; PH 717-354-1702; Dir; B-4,1; b. MI 1909; M-3; B.S. Wayne State Univ. 1953; A.A. PA State Univ. 1958; Fields: Stat & Meth. HAB; Mem: ASA, AMA, AEA; Dir: 5; Asst. Mgr. Stat. Hudson Motor Co. 1946-49; Asst. Prod. Cont. Mgr. Hudson Motor Co. 1945; Plng. Supvr. Hudson Motor Co. 1942-43; Stat. Hudson Motor Co. 1941.

HEDGES, Trimble, Dept of Agr. Econ. Univ of CA Davis CA 95616; PH 752-1529; Prof; A-1,4; b. OK 1906; M-2; B.S. OK State Univ. 1928; M.S. Univ of IL 1934; PhD Univ of IL 1938; Fields: Farm Mgmt. & Prod Econ. KFD; Res: Econ. of Fertilizer Use in Brazil; Econ. of Pesticide Use in CA; Lang: Fr. 1, 2,2; Ger. 1,3,2; Ita. 2,0,3; Mem: WAEA, AHS, ASFMRA, Ca.SFMRA, AAUP, SID; Prof. Univ. of CA 1938-47; Assoc. Prof. Univ of AR 1935-38; Asst. & Assoc. Prof. OK State Univ. 1931-35; Pub: Farm Mgmt. Decision 1963; Farm Mgmt. Manual 1965; Hon: PKP.

HEDLEY, Douglas D. Intl. Inst. of Tropical Econ. PMB 5320, Ibadan, Nigeria; Agr. Econ; A-2,1; b. Canada 1943; M-1; B.S. Univ of Guelph 1965; M.S. MI St. Univ. 1967; PhD MI State Univ. 1970; Fields: Farm Mgmt. & Prod. Econ. KG; Res: Prod. Econ. & Econ. Devl; Lang: Sp. 2,0,2; Fr. 3,0,0; Mem: CAES, AEA.

HEDLAND, Floyd F. Fruit & Vegetable Div. Consumer & Mkt. Service, USDA, Washington DC 20250; PH 388-4722; Dir; G-5,3, 4; b. NE 1911; M-0; B.S. Univ of NE 1933; PhD Cornell Univ 1937; Fields: Agr. Mktg. FJ; Lang: Fr. 2,0,2; Mem: IAAE; Dir: 1; Deputy Dir. USDA 1946-61; Br. Chief, USDA 1942-46; Head of Unit, USDA 1941-42; Agr. Econ. USDA 1937-41; Pub: ABC's of Federal Mktg. Orders & Agreements of Fruits & Vegetables, 1962; Export Apple & Pear Act, 1960.

HEDLUND, Glenn W. 112 Warren Hall, Cornell Univ. Ithaca NY 14830; PH 607-256-4579; Prof; A-3,1,2; b. NE 1909; M-3; B.S. Univ of NE 1930; PhD Cornell Univ 1936; Fields: Agr Mktg. DFK; Lang: Fr. 3,0,0; Ger. 3,0,0; Chi. 0,0,3; Mem: IAAE; Dir: 1; Dept Head, Cornell Univ 1952-68; Prof. & Dept Head, Penn State Univ. 1941-46; Asst. to Assoc. Prof. Cornell Univ. 1930-41; Hon: AZ, GSD, PKP, SX.

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HEIBY, Ernest P. Defense Supply Agency, Headquarters, Cameron Sta., Alexandria, VA 22314; PH 274-7166; Empl. Relations Spec; G-5; b. OH 1911; M-2; B.S. OH St. Univ. 1934; M.S. OH State Univ. 1938; Fields: Gen. Econ. Theory, CJ; Lang: Ger. 3,0,0; Dir: 5; Asst. Agr. Expt. Ser. 1934-41.

HEID, Walter George, FPED-ERS-USDA, Dept of Agr. Econ, MT State Univ. Bozeman MT 59715; PH 587-3121; Agr. Econ; G-1, A-1; b. MO 1932; M-3; B.S. Univ of MO 1959; M.S. Univ of MO 1960; PhD Univ of MD 1965;

Fields: Farm Mgmt. & Prod. Econ. FB; Res: Econ. Efficiency of Large Sized Farms; Mem: WAEA; Pub: Trends in Fertilizer Use 1970; Farm Adjustments of Econ. Effects, 1970; Costs & Returns Dryland Wheat Prod. 1970.

HEIDHUES, Theodor H. Institut fur Agrarökonomie, 34 Gottingen W. Germany; PH 42995; Prof; A-1,2; b. Germany 1933; M-3; Diplom, Gottingen Univ. 1958; PhD Cornell Univ. 1961; Habilitation, Gottingen Univ 1965; Fields: Agr. Prices, AF; Res: Dynamic Microecon Models of Agr. Change; Lang: Eng. 1,1,1; Fr. 2,3,3; Mem: GWVS; Pub: Entwicklungsmöglichkeiten Landwirtschaftlicher Betriebe Unter Verschiede Presiannahmen, 1966; Voraussetzungen und Agrarpolitik, 1969; Recursive Programming in Agr. Applications, 1970.

HEIDT, Anthony A. Res. Services, Dept of Coop. Legislative Bldg. Regina Saskatchewan, Canada.

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HEIFNER, Richard G. MED ERS USDA, Washington DC 20250; PH 202-962-4692; Ldr; G-1; b. IA 1934; M-3; B.S. IA State Univ. 1956; PhD IA State Univ 1963; Fields: Agr. Mktg. CHG; Res: Performance of Future Mkts; Mem: AEA, ASA, ES; Asst. Assoc. Prof. MI State Univ. 1963-69; Pub: Grain Inventories-quadratic Programming, 1966; Location of Vegetable Processing, 1968; Electronic Egg Exchange, 1968; Hon: PKP.

HEIN, Charles H. Jr. P.O. Box 1482, Bakersfield CA 93302; PH 393-2550; Sec-tres; B-2,3; b. CA 1941; M-3; B.S. Univ of CA 1963; Fields: Farm Mgmt. & Prod. Econ. DEC; Mem: ASFMRA; Asst. Farm Supt. Superior Farming Co. 1969; Foreman, Sunkist Growers, 1964-65.

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HELD, R. Burnell, Dept of Recreation Res. CO State Univ. Fort Collins CO 80521; PH 303-491-5358; Prof; A-2,1; b. IA 1921; M-5; B.S. IA State Univ. 1947; M.S. IA State Univ. 1949; PhD IA State Univ. 1953; Fields: Land & Water Econ. Cons. & Devl. KFI; Res: Value of Water in Alternative Uses; Lang: Ger. 3,0,0; Sp. 3,0,0; Mem: AAAS, AEA; Chief Research, U.S. Dept of the Interior 1965-67; Res. Assoc. Resources for the Future, Inc. 1955-64; Assoc. Prof. Penn State Univ. 1954-55; Asst. Prof. MI State Univ. 1953-54; Pub: Cons. in Perspective, 1965; Techniques for Determining Carrying Capacity of Natural Areas, 1969; Land for the Future, 1960; Hon: PKP, GSD, SX.

HELFINSTINE, Rex D. SD State Univ. Grad. School, Brookings SD 57006; PH 605-688-4181; Assoc. Dean & Prof; A-4,1,2; b. NE 1910; M-1; B.S. IA State Univ. 1932; M.S. IA State Univ. 1947; PhD Univ of CA 1958; Fields: Farm Mgmt. & Prod. Econ. E; Lang: Ger. 3,0,0; Fr. 3,0,0; Mem: AEA, WAEA; Acting Dept. Head, SD State Univ. 1966; Econ. ERS-USDA 1952-60; Pub: Econ. Comp. Irrigation & Dry Farming 1964; Res. Reg. Diff. Levels of Inc. 1968; Econ. Pot. Irrig. & Dry Farming, 1955; Hon: PKP, GSD.

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Commission on Withholding Taxes, 1957; Quantity Discount Pricing of Fluid Milk, 1956; Econ. Growth in MN 1969.

HELMBERGER, Peter G. 348 Agr. Hall, Dept of Agr. Econ. Univ of Wisconsin, Madison WI 53706; PH 262-3653; Prof; A-2,4,1; b. MN 1933; M-4; B.S. Univ of MN 1955; M.S. Univ of MN 1957; PhD Univ of CA 1961; Fields: Agr. Policy, BL; Res: Impacts of Farm Programs; Prof. Univ of CA 1968-69; Prof. Univ of WI 1961-68; Prof. Penn St. Univ. 1960-61; Pub: Co-Author: Estimation of Structure - Profit Relationships With Application to the Food Processing Sector, 1971; Coop. Enterprise as a Structure Dimension of Farm Mkts.

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HELMUTH, John William, AP&R, Indsl. Coll. the Armed Forces, Ft. L.J. McNair, Washington DC 20315; PH 693-8094; Res. Assoc; A-1,2 G-1; b. MO 1944; M-0; A.B. Univ of MO 1966; M.S. Univ of CT 1969; PhD Univ of MO 1970; Lang: Ger. 2,3,2.

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AEA; Dir: 5; Head Food Consumption Section USDA 1963-69; Agr. Econ. USDA 1960-63; Pub: Food Consumption, Prices & Expenditures, 1968; Rising Depreciation of Assets in Agr. Mktg. Firms, 1963; Growth Patterns in the Retail Grocery Business 1962.

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HOECHER, Harold H. 257 Symons Hall, Univ of MD, College Park MD 20742; PH 454-3805; Sr. Spec; A-3; b. MO 1916; M-1; B.S. IA State Univ. 1941; Fields: Agr. Mktg. K; Lang: Ger. 2,2,2; Mem: AMA; Dir: 1; Dairy Sanitation U.S. Dept of Health 1942-48; Pub: Mktg. Tree - Ripened Peaches 1965.

HOECKER, Raymond W. USDA, Federal Center Bldg. Hyattsville MD 20782; PH 388-8697; Asst. Dir; G-5,1; b. MO 1913; M-4; B.S. IA State Univ. 1936; M.S. Cornell Univ. 1939; PhD Cornell Univ 1941; Fields: Agr. Mktg. KJ; Res: Improve Physical Handling of Food & Farm Products Through the Mktg. System; Mem: AMA; Chief Wholesaling & Retailing Br. 1949-68; Prof. Univ of MD 1947-49; Econ. Bur. of Agr. Econ. 1943-47; Asst. Prof. KS State Univ. 1941-43; Dir: 1,2,3, & 5.

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2773; Agr. Econ; G-1; b. OH 1942; M-2; B.S. OH State Univ. 1965; M.S. Univ. of MO 1968; Fields: Farm Mgt. & Prod. Econ; Res: Income Effect of Govt. Tobacco Programs on Burley Growers; Lang: Fr. 2,3,3; Cost Acct. Farm Corp. 1962-63; Pub: Risk Aversion Characteristics Among PCA Borrowers 1968; Hon: GSD.

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for a Sugar Plantation Containing Several Climatic Zones or Irrigation Investments Under Uncertain Climatic Conditions; Lang: Por. 2,3,2; Sp. 2,0,0; Dir: 5; Agr. Econ. USDA 1965-71; Pub: The Delivered Crop Demand for Moloka: Irrigation Project Water, 1966; Optimum Irrigation Investment for a Sugar Plantation Occupying Several Climatic Zones, 1971.

HOGLAND, C. Raymond, Dept of Agr. Econ. MI State Univ. East Lansing MI 48823; PH 517-355-1807; Prof; A-2,3,1; b. KS 1906; M-1; B.S. Univ of MN. 1940; M.S. Univ of MN 1941; Fields: Farm Mgmt. & Prod. Econ. DEJ; Res: Adjusting Dairy Farming; Mem: ADSA; Dir: 5; Assoc. Prof. SD State Univ. 1943-48; Econ. Univ of WI & SCS USDA 1941-43; Farm Mgr. Metropolitan Life Insurance Co. 1935-40.

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HOLLOWAY, Milton Lee, 230 Monroe Street, ERS USDA, Corvallis OR 97331; PH 752-4281; Agr. Econ; G-1; b. TX 1939; M-2; B.S. TX Tech Univ 1965; M.S. TX Tech Univ 1968; PhD OR State Univ 1971; Fields: Land & Water Econ. Cons. & Devl. HAF; Res: Prod. Function Anal. of Water Resource Productivity in Pac. N.W. Agr; Res. Asst. TX Tech Univ 1965-66.

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Pub: The Farm Poor: Counted, Miscalculated, Discounted, 1969; Impact of Public Spending in a Rural Area 1968; Private Outdoor Recreation Facilities in Rural Areas of W. Oregon 1964.

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HOLZ, Alan E. Fats, Oils Div., Foreign Agr. Service, USDA, Washington DC 20005; PH DU8-2030; Agr. Econ; G-1,4; b. IL 1953; M-2; b. IL 1933; M-2; B.S. Univ of IL 1957; M.S. Univ of IL 1959.

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HOOS, Sidney S. Giannini Found. Univ of CA Berkeley CA 94720; PH 415-042-3349; Prof; A-2,1, B-1; b. NY 1911; M-2; A.B. Univ of MI 1934; A.M. Univ of MI 1935; PhD Stanford Univ 1939; Fields: Agr. Mktg. CFL; Res: Mktg. Bds; Lang: Fr. 2,3,2; Ger. 2,3,2; Mem: WAEA, AEA, ES, ASA, IMS; Dir: 1,2,5; Chief Econ. U.S. War Dept. 1942-45; Chief Econ. USDA 1941-42; Instr. Univ of CA 1935-41.

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AZ Grapefruit Prices, 1966; Grapefruit Consumption & Prices Go Down, 1966.

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Grain Elevators in the West Coast, Canada;
Lang: Eng. 1,1,1; Mem: CAES; Post Doctoral
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Grain Storage Inventories, 1971; Econ.
Evaluation of Irrigation Water-Manitoba,
An Investigation of Prod. Response of Beef-
Hog Farms in Ontario, 1965.

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State Univ. 1965-70; Asst. Prof. NC State
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1957-60; Pub: Costs & Returns for 2 years
of Post-Secondary Tech. Schooling, 1967;
Program Evaluation, 1968; Cost Functions
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in So. IA 1964; Hon: PKP.

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tinuous Sequence Processes 1969; Price Re-
fraction in Pork Processing, 1968.

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Devl. Plng. 1971; Supplement to No. 531,
1971; Coop. Mktg. Act of Ohio 1971.

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Machine Services; Lang: Ger. 3,0,0; Fr.
3,0,0; Mem: AEA, SAEA; Agr. Econ. FPED
ERS USDA 1961-68; Pub: Beef, Pork &
Grains in the Corn Belt, 1967; A Com-
parative Review of Some Firm Growth Mod-
els, 1968; Flow of Funds, Social Account
for the Farm Sector, 1971; Hon: PKP, SX,
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JAMES, Sydney C. Dept of Econ. IA State Univ. Ames IA 50010; PH 294-5436; Prof; A-1,2; b. UT 1928; M-5; B.S. UT State Univ 1953; M.S. UT State Univ. 1957; PhD OR State Univ. 1961; Fields: Farm Mgmt. & Prod. Econ; Res: Swine Ind. Study, Beef Cow Study, Farm Records Study; Asst. Prof NM State Univ. 1961-63; Pub: Midwest Farm Planning Manual 1968.

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JANSEN, Edmund F. 108 Morrill Hall, Univ of NH, Durham NH 03820; PH 862-1700; Assoc. Prof; A-1,2; b. IL 1933; M-4; B.S. Univ of IL 1960; M.S. NC State Univ. 1964; PhD NC State Univ. 1966; Fields: Econ. Devl. JEB; Res: Community Services for Non-Metropolitan People in the Northwest; Lang: Sp. 2,2,1; Mem: AEA; Visiting Asst.

Prof. NC State Univ. 1965-68; Res. Instr. NC State Univ. 1963-65; Pub: Econ. Effect of Powterhaway State Park, 1971.

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JANSEEN, Melvin R. Econ. Devl. Div. ERS USDA, Washington DC 20250; PH 202-962-1908; Asst. Dir; G-1,5; b. IL 1921; M-4; B.S. Univ of IL 1948; M.A. Harvard Univ. 1948; A.M. Harvard Univ. 1949; PhD Harvard Univ. 1953; Fields: Econ. Devl. AFD; Mem: WAEA, AEA, SAEA; Dir: 5; Res. Asst. Univ of IL 1946-47; Agr. Econ. Bur. of Agr. Econ. 1949-53; Hon: SX.

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1,2,1; Mem: TC, LI; Field Rep. Tri State Livestock Cr. Corp. 1969-70; Farm Mgmt. IRI Res. Inst. 1967-69; Assoc. Rep. ASU U.S. Peace Corps 1964-67; Pub: Value of Public Grazing Permits, 1966.

JEFFREY, Arthur D. Harthouse 36 Upper College Road, Univ of RI, Kingston RI 02881; Prof; A-1,2; b. PA 1917; M-2; B.S. Penn State Univ 1939; M.S. Penn State Univ 1953; PhD Penn State Univ 1956; Fields: Land & Water Econ. Cons. & Devl K; Res: Land Use Controls in RI; Mem: AEA, IAAE, AAAS; Dir: 5; Prof. Univ of RI, 1968- --; Assoc. Prof. Univ of RI, 1959-68; Pub: Extensions Involvement in Politics: A Case Study, 1970; Econ. Devl. in RI in the year 1975, (pub. 1970). Hon: PGM.

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JENKINS, Larry G. Box 725, Rollo MO 65401; PH 314-364-3147; Farm Mgmt. Spec; A-3; b. U.S. 1939; M-2; B.S. Univ of MO 1961; M.S. Univ. of MO 1965; PhD Univ of KY 1970; Fields: Farm Mgmt. & Prod. Econ. GCF; Lang: Ger. 3,3,3; Hon: AZ, AGS.

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MD 1961; M.S. Univ of MD 1965; PhD Univ of MD 1969; Fields: Econ. Devl. EG; Res: Cost Sharing in Fed. Grant Programs; Lang: Ger. 3,0,0; Sp. 3,0,0; Mem: ASA, RSA; Econ. Natural Water Comm. 1970- --; Exec. Dir. Calvert Co. Econ. Devl. Corp. 1968-70; Econ. USDA ERS 1966-68; Res. Devl. Anal. Univ of MD 1962-66; Pub: The Potential Wine Grape Ind. 1971; Overall Econ. Devl. Program, 1970; Interindustry Anal. of MD Agr. Econ. 1969.

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Lang: Fr. 2,0,0; Dir: 5; Prof. Univ of KY 1948-51; Soc. Econ. Stat. USDA, 1942, 1943 & 1946; Pub: Farm Mgmt. Anal. 1952; Overproduction Trap, 1971.

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Theory, HJ; Res: Intl. Trade in Agr. Prod; Lang: Sp. 2,0,3; Fr. 3,0,0; Mem: AEA; Prof. of Econ. NC State Univ 1953- --.

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Assoc. Prof. Univ of CA 1970; Assoc. Prof Univ of CT 1967; Asst. Prof. Univ of MO 1964; Pub: Agr. Land Price Differentials 1970; Renewness & Expenditness in Large U.S. Cities, 1971.

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JOHNSON, Stewart, Dept. of Agr. Econ. Univ of CT, Storrs, CT 06268; PH 203-429-3311; Prof; A-2,3,1; b. WI; M-2; B.S. Univ of WI 1935; M.S. Univ of VT, 1937; PhD Cornell Univ 1941; Fields: Agr. Mktg. CFD; Res: Dairy Mktg; Dir: 5; Ext. Agr. Econ. Cornell Univ. 1941-45; Agr. Econ. Univ of VT 1937-41; Ext. Econ. Univ of WI 1935-36.

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Size in IN Beef Cattle Feedlots, 1971; The Impact of Govt. Subsidizes Farm Operating Loans on Family Labor Employment in Agr. 1966; Hon: PKP, GSD.

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RSNZ, ASA; Dir: 1,5,6; Chf. Soil Survey, USDA, 34-71; Pub: The Soils that Support Us, 1941; Potentially Arable Soils of the World, 1969; Interactions in Agr. Devl., 1962.

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1954-57; Econ. FAO, UN, 1948-51; Pub: Consumer Demand for Food Commodities, 1971; Reg. Resource Use for Agr. Prod. in CA, 1970; Reg. Location of Cattle Feeding, 1963.

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Pub: Comparison of Slat & Bedded Floor Beef Confinement, 1971.

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Fr. 3,0,0; Sp. 3,0,0; Mem: NEAEC; Dir: 6,7,8; Assoc. Prof., Univ. of CT, 61-66; Asst. Prof. Univ. of CT, 54-61; Pub: Spatial & Temporal Alloc. of Milk, 1971; Anatomy of a Step Supply Function, 1967; Short-Cut Approach for Linear Programming, 1967; Hon: GSD.

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Lang: Sp. R2,0,0; Fr. R2,0,0; Mem: AEA, AFEA, Agr. Stat. USDA, 49-62; Pub: Crop-land Trends Since WW II, 1970; Air Photo Use in Resource Mgt, 1969; Major Land Use in the U.S., 1967.

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Fr. 3,0,0; Ger. 3,0,0; Mem: AAAS,AEA,ASA, ES,IAAE,SAEA; Visting Assoc. Prof., Univ. of MN, 68-69; Asst. Prof., LA St. Univ., 60-62; Pub: Evaluation Supply Control Policies for Frozen Concentrated Orange Juice with an Indsl. Dynamics Model, 1970; Pesticide Residues & Environmental Econ., 1970; Dynamic Linear Programming Model for Devl. Plng., 1968.

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Commercial Sod Prod. in MD; Mem: AEA, SAEA, NAEC; Dir.: 5,6; Asst. Univ. of MO, 62-65; Instr. Univ. of AR, 60-62; Pub: Structure of MD Sod Ind.: Costs & Returns, 1971; Intl. Trade in Selected Grains & Meats, 1972; Hon: GSD, AZ, APZ, PKP.

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Lang: Ger. 3,3,3; Fr. 3,3,3; Mem: AAUP, SAEA, Assn. of South. Agr. Workers, AL Stat. Assn.; Asst. Prof. AR St. Univ., 66-67; Pub: AL Comp. Statewide Outdoor Recreation Plan, 1970; Factors Affecting Outdoor Recreation Visitation, 1971; A Use of Cluster Anal. in Outdoor Recreation Res., 1971; Hon: AZ, PKP, AGR.

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Tobacco Ind.; Owner-Mgr. Farm Supply Bus.; 50's; Owner-Mgr. Old Boat Locks, 40's; Pub: The Hired Farm Working Force, 1971; Fruit & Vegetable Harv. Mech. Policy Implications, 1970; Hon: PKP, AZ.

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3,3; Mem: AEA,IAEA,AMA,SID,AAAS: Dir: 1,3, 5,6,7,8; Assoc. Prof. Univ. of NE, 56-66; Pub: Mktg. & Econ. Devl., 1967; Hon: AKD, GSD,PC.

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Mem: SID AEA, AAUP, AMA: Dir: 1,2,5; Econ. UN Special Fund Proj., 63-65; Dir. of Res. IN Farm Bur. Corp., 60-63; Res. Asst. OH St. Univ., 50-60; Pub: Cost of Non-Resident Students & Their Contribution to the NM Econ., 1969; Milk Distribution Systems & Per Capita Consumption, 1960; Hon: GSD.

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of City Size; Lang: Sp. 2,2,3; Mem: CAES, CDS, SAEA, WAEA; Pub: The Cost of Controlling Crime: a Study in Econ. of City Size, 1971; Hon: AZ, PES, PKD.

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Policy; B,J,L; Lang: Eng. 1,1,1; Fr. 1,2,1;
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The European Mkt. Plans, 1957.

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Res: Econ. of Transp.; Mem: AMA, FDRS; Dir.
of Mktg. Res. Consolidated Freightways, 55-
61; Pres. Moser's Inc., 51-55; Asst. Dir. of
Ext. City Col. School of Bus., 43-51; Pub:
Transp. in Agr. & Bus., 1964; Guidelines for
Transp. Educ. Program, 1969; Hon: BGS, GSD.

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Sp. 1,0,0; Mem: IAAE, SID; Visting Prof.
Cornell Univ., 55-57; Visting Prof. Univ.
of Chicago, 53-55; Instr. to Prin. Allahabad
Agr. Inst., India, 33-53; Pub: Tech. Cooper-
ation in Latin Am., 1957; Getting Agr.
Moving, 1966; Creating a Progressive Rur.
Structure, 1969.

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USDA, 65-69; Econ. ERS-USDA, 60-65.

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Sp. 2,2,2; Mem: AAUP, AAAS, AEA; Dir: 1,5;
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World Bank, 60-62.

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Application of Quantitative Techniques to
Prod. Behavior; Mem: ASA, AEA, ES.

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E,F,A; Lang: Fr. 3,0,0; Sp. 2,0,0; Mem:
SAEA, CDS, SCDA; Dir: 5; Prof. Unvv. of FL,
58-todate; Assoc. Prof. Univ. of FL, 55-
58; Pub: Basic Steps in Resource Devl.,
1961; Agr. Econ. Handbook, 1956; Cost Acctg.
for the Nursery Industries, 1957.

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Devl., G,B,K; Res: Econ. of Land Data Sys-
tems; Mem: SCSA; Ldr. NRED-ERS-USDA, 68-69;
Chf. Crop Stat. Br.-Bur. of the Census, 66-
68; Stat. Bur. of the Census, 62-66; Pub:
Land Tenure in the U.S., 1969; 1964 Census
of Agr.-Crops: Chap. 4, Vol. II, 1967;
Problems in Implementing Improved Record
Systems, 1969; Hon: GSD.

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Linear Program for Machinery Selection, 1970.

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Devl., L,F,H; Res: A Stochastic Recursive
Programming Model of Agr. Devl. in the Pun-

jab, India; Lang: Eng. 1,1,1; Mem: AEA, ES; Grad. Fellow, Univ. of WI, 69-71; Res. Asst. Univ. of WI, 67-69; Grad. Fellow Punjab Agr. Univ., 65-67; Pub: A Dynamic Microeconomic Anal. of the Agr. Sector: The Punjab, 1970; Rationale of Maximum Cr. Limit Based on Farm Prod. Plans, 1969; Distr. of Agr. Processing & Supply Ind. in Punjab, 1966.

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1962; Devl., Organization & Mechanization of Sugar Beet Prod., 1956; Hon: PKP, AZ.

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Latin Am. Agr.; Lang: Sp. 1,3,2; Instr. Dept. Econ., Montgomery Col., 70-71; Tching. Asst. Univ. of MO, 57-68; Pub: Sources of Agr. Growth in LA, 1971; Hon: PKP,ODE,GSD.

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69; Pub: Wyoming Agr. - Past, Present, Future, 1971; A Technique to Estimate the Impact of Agr. Res. Adjustments Upon an Area Economy, 1969; Agricultural Adjustments & Area Econ. Interrelationships, 1966.

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Peppers, Irish Potatoes & Tomatoes, 50-66, 1969; Hon: PKP, ODE.

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Water Resource Devl. Cape Fear River Basin, NC; Mem: IAAE, AEA; Farm Mgr. Doane Agr. Suc., 60-65; Agr. Econ. USDA, 57-59; Pub: Agr. Acting Susquehanna River Basin, 1968; Agr. Water Requirements Susq. River Basin, 1968; Compara Meater, 1962; Hon: GSD.

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Oppor. for NC Dairy Producers; Lang: Fr. 3, 0,0; Mem: AEA; Dir: 5; Econ. ERS-USDA, 62-63; Asst. Prof. NC St. Univ., 63-67; Pub: The Effect of Length of Run or Measured Demand Elasticities, 1965; An Anal. of Intraseasonal Apple Price Mounts, 1965; Hon: GSD.

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& Adjustments in Soy Bean Prod.; Lang: Fr. 2,0,0; Dir: 6; Res. Asst. LA St. Univ., 65-67; Pub: Toward an Info. System for Guiding Res. in the Soy Bean Prod. Econ., 1971; Farmland Mkt. in Delta Cotton Reg., 1968; The Farming Sector & ME Value Added Tax, 1971; Hon: PKP, DTA, ATA, GSD, SX.

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tems of the Philippines; Lang: Eng. 1,1,1; Mem: FEAP, IAAE, ISAS, PSA; Chf. Stat. Coord. Bur. of Census & Stat., 68-todate; Cons. Bur. of Census & Stat., 67-68; Pub: Rice Mills & Cost of Milling, Palay in Nueva Ecija, 1967; The Oper. of Corn Wholesalers, Millers & Retailers in the Philippines, 1959; The Present Situation & Outlook of the Rice Mktg. with Emphasis on Their Implications & the Present Rice Problems of the Country, 1965.

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Diversified Agr. of HI, 1953; Issues of Crop Settlement in Devl. Countries, 1972; Requirements for Success of Village Coops. in Devl. Countries in Asia, 1966; Hon: Fullbright Res.

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Asst. Prof. Univ. of Alta, Can., 68-70; Pub: Cons. of the CA Tule Elk, 1970; So 10- Econ. Value of Biological Resources: The Case of Peace - Athabasca Delta in Alberta, 1971; Hon: GSD.

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Col., 64-66; Pub: Prospects for Black Farmers in the Years Ahead, 1971; Cashier Labor Scheduling in Supermarkets, 1964.

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0,3; Mem: CDS, Dir. & Asst. Prof. Purdue Univ., 64-66; Assoc. Prof. Univ. of WI, 61-64; Instr. Univ. of WI, 55-61; Pub: Pub. Programs Directed Toward Improved Living in Rur. Areas, 1970; A Matter of Knowledge & Will, 1970.

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Asst. Chf., PSD Dept. Govt., 1969; Pub: Fertilizer Price Policy in W. Pakistan, 1970; Agr. in the Regions of W. Pakistan, 1970; Agr. Income in W. Pakistan, 1970.

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A,K,F; Lang: Sp. 2,0,0; Econ. Vietnam, 70-71; Econ. Dept. Supp. Agency, 69-70; Pub: Econs. of Canned Ham Procurement, 1970; A Theoretical & Procedural Approach to Estimating the Differential Value of Live Hogs & Pork Carcasses.

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RSA, SSSA, NABE; Dir: 1,5,6,7,8; Econ. USDA, 41-66; Pub: Crossroads Community Study for Dallas, TX, 1970; Econ. Feasibility of Proposed Lake Shore Rd. in Malawi, 1965; The Econ. of the Central Bus. Dist. of Dallas, 1961.

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M Univ., 40-41; Pub: Bus. Org. for Modern Farms, 1970; Custom Rates for Farm Oper., 1970; Machinery Cost & Performance, 1970.

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Univ. of WI, 56-61; Assoc. Prof. Univ. of WI, 61-65; Farm Mgt. Cons. A.F.B.F., 1962; Dept. Chmn. Univ. of WI, 66-70; Pub: The WI Electronic Farm Records Program, 1965; Farm Mgt. Educ. Programs for the Future, 1967; Relative Profitability of Soil Cons. Practices, 1962; Hon: GSD.

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Fields: Agr. Mktg., C,F,L; Res: Sys. Anal. of U.S. Grain Mktg. System; Lang: Sp. 3,0,0; Mem: SAEA; Grad. Asst. OK St. Univ., 64-67; Pub: Econ. of Size Non Slaughtering Meat Processing Plants, 1968; No. & Size of OK Grain Elevators, 1969; Hon: GSD.

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for Mkt. & Processing; Lang: Ger. 2,0,0; Sp. 2,0,0; Mem: ASHA, PAA; Dir: 1,5; Prof. Univ. of WI, 50-todate; Pub: Potato Grading & Mktg., 1968; Vegetable Enterprise Selection, 1964; Ext. Problem Solving, 1962.

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Farming; Lang: Fr. 1,1,0; Mem: IAAE, AESI, AES; W. Reg. Officer Dept. of Agr. & Fisheries, 65-todate; Farm Mgt. Adv., 62-65; Pub: The Influence of Family Size on Efficiency within the Farm, 1962; Inter-Area Resource Productivity Comparisons in Irish Agr., 1964; Hon: GSD.

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cess of Econ. Growth, 1970; Capital Mkts., Stability & Growth, 1970; The Impact of the MN Usury Law, 1971.

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Income of Farm Oper. Families; Mem: IAAE, AEA; Agr. Econ. USDA, 67-69; Pub: Gen. Crop-land Retirement, 1971; The Representative Farm Approach & Estimation of Supply Response, 1969; Evaluation of a Firm Model in Estimating Aggregate Supply Response, 1968.

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Irrigation Systems, S.W. NE; Lang: Ger. 2, 0,0; Sp. 3,0,0; Supt. Univ. of NE, 66-71; Asst. to Dean, Univ. of NE, 61-66; For. Student Adv., 63-63; Exec. Sec. Great Plains Wheat, 59-61; Pub: Impact of Center-Pivot Irrigation in S.W. NE, 1970; Hon: GSD, AZ.

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Univ., 27-69; Econ. Cons. Weitz-Hettelsater 70-71; Pub: Mktg. Farm Prod., 1970; Agr. Price Anal. Farm Policy, 1970; New Directions, 1964.

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Livestock Prod. & Mktg.; Lang: Sp. 1,2,3; Mem: RBA; Treasurer & Mgr. Lawnel Farms, 54-68; Pub: Manpower Supply in Wastewater Treatment Plants, 1970.

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Cons. & Devl.; Res: Econ. Impact of Second
Homes; Lang: Fr. 3,0,0; Ger. 3,0,0; Mem:
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NWFMA; Farm Mgt. Econ. Coop. Ext. ND St.
Univ., 61-70; Co. Agt. Coop. Ext., 58-60;
Asst. Co. Agt. Coop. Ext. ND St. Univ., 57-
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Study of Beef ind. in Australia; Lang: Eng.
1,1,1; Jap. 2,2,2; Mem: AEA, AAEA, ASA; Res.
Asst. Univ. of HI, 67-70; Pub: A Spatial
Equilibrium Model of Beef Ind. in U.S.A.,
1971; Hon: GSD.

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dexes, World Fishery (Demand Supply) Lang:
Arabic 1,1,1; Fr. 2,3,3; Czech. 3,3,3; Mem:
AEA, ASA, ES; Dir: 6,7; Stat. U.A.R., Cairo,
1962; Pub: Quarterly Econometric Model of
the Turkey Ind., 1970; Stat. Anal. of Cyc-
lical Variation in the Nat'l Turkey Mkt.,
1971; Econ. Anal. of U.S. Turkey Prices &
Producer Income, 1971.

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Models for Farm Bus. Plng.-Forage & Beef;
Lang: Ger. 3,3,3; Mem: CAEA, AIC; Dir: 6;
Econ. D.W. Carr & Assoc., LTD., 66-67;
Pub: Maritime Farm Enterprises Anal., 1969;
Optimum Ctans. for Small Farms in N.E.
Sask., 1967; Supp. Irrigation in the S.
Sask. River Irrigation Project, 1965.

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Corners Area; Lang: Por. 2,2,2; Mem: AEA,
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Land & Water Econ. Cons. & Devl., K; Res:
Red River of the North Type II River Basin
Study; Res. Asst. Univ. of WY, 66-68; Pub:
Marginal Value of Irrigation Water & a Case
Study of Transfer in S.E. WY, 1970.

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Plains Agr.; Visting Prof. Univ. of MN, 62-
63.

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Ingenieros Agronomos; Dept. Hd. Ministry of Agr. & Ganaderia, 1963.

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Cotton, 1958; Transp. of Cattle in the West, 1969; Net Returns to Producers for Cattle, 1968; Hon: AZ, GSD.

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STEINMUELLER, Milton H., Dept. of Res. Devl., MI St. Univ., E. Lansing, MI 48823; Ph: 351-3765; A1,2,3,4; b. WA, 1924; M-2; B.S. WA St. Univ., 1949; M.A. WA St. Univ., 1952; PhD MI St. Univ., 1958; Fields: Land & Water Econ. Cons. & Devl., K,F,J; Mem: SCSA, MTS.

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Univ., 1965; Fields: Land & Water Econ. Cons. & Devl., F,K; Res: Determinants of Income & Mobility in OR's Extractive Inds.; Lang: Sp. 2,3,3; Mem: WEA; Asst. Prof. Univ. of CA, 65-66; Res. Fellow OR St. Univ., 64-65; Pub: Recreation Benefits from Water Pollution Control, 1966; Measurement of Econ. Values in Sport Fishing, 1969; Hon: SX.

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Variation & Selection of Enterprises, 1966; An Overview of Social & Econ. Issues Confronting the Tobacco Ind. in the 70's, 1971; Changing Resource Requirement on Farms in the South, 1968.

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Found., 60-61; Res. Investigator Export Promotion Council Ministry of Ind. & Commerce, 56-57; Pub: Omissions in the Treatment of the Law of Variable Proportions, 1966; An Anal. of Factors Affecting The Cost & Handling & Storing Grain in Manitoba Country Elevators, 1967.

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WRSA, RSA; Prof. OK St. Univ., 67-todate; Cons. USDA, 1967; Pub: Found. of Farm Policy, 1970; Root of the Farm Problem, 1965; Resource Demand & Structure of Agr. Ind., 1963.

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Assoc. Prof. Purdue Univ., 1967-todate; Dir. of Econ. Res. Farmers Gr. Dealers Assn., 1967; Asst. Prof. IA St. Univ., 65-66; Pub: Econ. Effects of Changes in Transp., 1965; Devl. of an Agr. Fin. Prog. at Purdue Univ., 1971; Hon: AZ, SX.

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tion of CO River Water Allocation Plan for AZ; Lang: Ger. 2,3,3; Mem: ES, AEA, CAEA; Grad. Asst. MI St. Univ., 64-66; Pub: Networks & Mathematical Programming, 1970.

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Meat Animal Res., 1968; Interpreting Live-stock & Meat Mkt. News, 1970.

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Estate Plng. for NC Farm Families, 1970; An Anal. of Factors Related to the Cost of Producing Milk & Milk By-Prod. on NC Dairy Farms, 1970.

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Shell Chem. Co., NY, 67-68; Pub: Trends in
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Econ. Federal Reserve Bk., 58-63; Hon: LA.

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Fr. 1,2,2; Mem: ES, AEA, RES, RSS, IAAE, SID;
Dir: 1; V. Pres. Agr. Devl. Council, 58-69;
Pub: Subsistence Agr. & Econ. Devl., 1969;
Res. on Agr. Devl. in S.E. Asia, 1965; U.S.
Grad. Trng. Asian Agr. Ecsts, 1959.

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Purdue Univ., 46-47; Pub: Reorg. & Devl. of
TN Farms, Ames Plantation, 1969; Hon: AZ,
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of Commerce, 67-71; Pub: Industrial Fish-
ery Prod. Situation & Outlook Reports, 68-
70; Forest Serv. Res. Reports, 1967; Hon:
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Pub: The Range Cattle Ind. of the North
Gr. PL, 1970; Tsetse Fly Eradication &
Livestock Devl., Africa, 1968; Optimum
Livestock Systems Under Certainty & Un-
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Theory Model, 1968.

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1,1,1; Mem: IAAE, SBER; Dir: 5; Agr. Econ.
USAID, 65-68; Proj. Ldr. MI St. Univ.,
62-65; Pub: Plng. for Successful Dairying
in N. England, 1955; Pub. Law 480 and
Columbia's Econ. Devl., 1944; Adm. Rur.
en la Reforma Agraria y el Desarrollo Econo-
mico, 1963.

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2,0,3; Mem: IAAE, AEA, BSAE; Post-Doctoral
Fellow, Ut St. Univ., 70-todate; Asst.
Prof. Purdue Univ., 1970; Pub: Labor Absorp-
tion in Ind. in Brazil, 40-60, Pub. 1969;
Labor Absorption & Devl. Policy in Brazil,
1971; Bibliography on Econ. of Agr. Prod.
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Econ. of Soybean Mktg., Consumer Acceptance of Soy Prod.; Lang: Fr. 3,3,3; Dir: 2,5; Assoc. Prof. Auburn Univ., 47-52; Pub: Org. & Competition in the Midwest Dairy Industries, 1970; Impact of Food Chain Procurement Policies on the Fluid Milk Processing Ind., 1970.

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Mktg., J,D; Res: Factors Contributing to Coop. Success; Lang: Sp. 2,0,0; Tur. 3,0,0; Mem: AEA; Dir: 1,5; Prof. So. IL Univ., 56-todate; Pub: Intro. to Grain Mktg., 1971; Hon: PKP, GSD, Fulbright Prof.

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Sp. 3,0,0; Fr. 3,0,0; Mem: WAEA; Dir: 6; Post-Grad. Res. Agr. Econ. Univ. of CA, 68-69; Pub: Eval. Procedures of the U.S. Army Corps of Engr.: The Dos Rios Project.

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Eng. 1,1,2; Mem: AESJ; Tchr. Tachio H.S., 59-63; Pub: Intervention & Price, 1965; Basic Problems in Agr. Mktg., 1969; Estimation of Agr. Protection Costs, 1970.

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Empirical Study-Agr. Labor Mkt. in Devl. Co., Brazil, 1968; Econ. in Reg. Water Res. & Policy, 1969.

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ZAMAN, M. R., Dept. of Agr. Econ., Cornell Univ., Ithaca, NY 14850; Ph: 256-2104; Res. Assoc.; A2,1; b. E. Pakistan, 1942; M-1; B.A. Dacca Univ., 1963; M.A. Dacca Univ., 1964; PhD Cornell Univ., 1970; Fields: Agr. Policy, J,K,C; Res: Green Revolution & Its Effects on Empl. & Income Distr. in Pakistan; Lang: Uru 2,2,1; Eng. 1,1,1; Mem: NGA, SID; Res. Econ. Pakistan Inst. of Devl. Econ., 64-71; Pub: Marketed Surplus Function of Maj. Agr. Commodities in Pakistan, 1966; The Econ. Implications of a Complete Free Trade & an Alternative Farm of Free Trade in Sugar through 1980, 1970.

ZAPATA, Juan Antonia, U. Nacional de Cuyo Godog, Cruz Mendoza, Argentina; Prof.; A 1,2; b. Argentina, 1943; M-3; Contador Publico Nacional, Univ. Nacional de Cuyo, 1964; M.A. Univ. of Chicago, 1967; PhD Univ. of Chicago, 1970; Fields: Land & Water Econ. Cons. & Devl., L,H,K; Res: Eval. of Irrigation Projects; Lang: Eng. 1,1,1; Mem: IAAE, AEA.

ZAWADZKI, Michael I., DWR. 849 S. Broadway, Los Angeles, CA 90014; Ph: 620-4723; As oc. Res. Econ.; G4,1,5; b. Poland, 1915; M-1; M.S. Univ. of Warsaw, 1938; B. Lit. Univ. of Oxford, 1950; PhD Univ. of IL, 1955; Fields: Land & Water Econ. Cons. & Devl., J,B,K; Res: Coordinated Statewide Plng. of D.W.R., So. Dist. of CA; Lang: Ger, 2,3,3; Mem: WAEA, WEA; Dir: 5,6,7; Asst. Prof. Loyola Univ., 59-61; Asst. Prof. Univ. of RI, 55-59; Res. Assoc. Univ. of Chicago, 1955; Pub: Rhodesia, 1943; Egg Supply & Mktg. in NC Region, 1942; Factors Affecting Consumption of the Dry Skim & Evaporated Milk, 1960.

ZEGERS-PRADO, Christian, 2392 W. Larpenteur Apt. 1, St. Paul, MN 55113; Prof.; A5; b. Chile, 1941; M; Ingeniero Agronomo, Univ. of Catolica de Chile, 1964; M.S. ND St. Univ., 1968; Fields: Farm Mgt. & Prod. Econ.; Lang: Sp. 1,1,1; Eng. 1,1,1; Fr. 2,2,2; Mem: CAEA, CAAA; Dir. & Prof. Inst. Economia Agraria de la Universidad Austral de Chile, 68-71; Pub: Estudio Economico en Lecherias de la Province de Valdivia, 1971; Evaluacion Programa Ganadero Sur. 1970, Pub. 1971.

ZELNER, Mary D., Dept. of Agr. Econ., MI St. Univ., E. Lansing, MI 48823; Ph: 355-2288; Ext. Spec.; A2,3; b. MA, 1934; U; B.S. Cornell Univ., 1956; M.S. MI St. Univ., 1961; Fields: Agr. Mktg., I; Res: Consumer Attitudes Toward Food Prod. & Packages; Mem: AHEA, ADA; Ther. Diet. Univ. of Rochester, 57-59; Diet. Inter Univ. of MI, 56-57.

ZEHR, Donald E., 519 E. 11th St., Columbus, OH 43211; Ph: 299-4134; Gen. Mgr.; B1; b. IN, 1913; M-1; B.S. Purdue Univ., 1936; M.S. OH St. Univ., 1958; PhD OH St. Univ., 1960; Fields: Agr. Mktg., C,F,J; Gen. Mgr. OH Coop. Milk Producers, 1971; Milk Mit. Spec. OH St. Univ., 57-61.

ZELLNER, Rober Earl, Dept. of Agr. Econ., Univ. of Guelph, Guelph, Ontario, Canada; Post-Doctoral Cellow; A2,4; b. FL, 1944; M-0; B.S. Univ. of FL, 1966; M.S. Univ. of FL, 1968; PhD Univ. of MO, 1971; Fields: Agr. Prices, H,K; Res: Econ. Anal. of Terminal Hog Mkts.; Wheat Yields in Mexico; Cattle Futures Mkts.; Econometric Model of Livestock Feedgrain Econ. of Ontario; Mem: SID, ES; Asst. Res. Econ. FRB OF Atlanta, 1967.

ZEPP, Glenn A., Dept. of Agr. Econ., Univ. of FK, Gainesville, FL 32601; Agr. Econ.; G1,4; b. PA, 1936; M-3; B.S. PA St. Univ., 1960; M.S. PA St. Univ., 1963; PhD PA St. Univ., 1967; Fields: Farm Mgt. & Prod. Econ. F; Res: Econ. of Mechanization in Fruit & Vegetable Prod.; Lang: Fr. 3,0,0; Sp. 3,0,0; Mem: AEA; Pub: Gen. Cropland Retirement Anal. of Four Alternatives, 1971.

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ZORAL, Kutlu Yasar, Dept. of Agr. Econ., Ataturk Univ., Erzurum, Turkey; Asst. Prof.; A1,2; b. Turkey, 1936; M-2; B.S. Istanbul Univ., 1958; M.S. MT St. Univ., 1964; PhD Ataturk Univ., 1966; Fields: Farm Mgt. & Prod. Econ., C; Res: Resource Productiity in Pasinler Plateau, Eastern Turkey; Lang: Eng. 1,2,2; Fr. 2,2,3; Mem: SID; Dir: 6; Pub: Alternative Use of Hp. Resources in Black Sea Coast, 1966; Cattle Feedings Ind. in Farjorum & Erjineau, 1968.

ZULBERTI, Carlos A., Warren 313, Cornell Univ., Ithaca, NY 14850; Ph: 256-4545; Grad. Student; A5,2; b. Argentina, 1944; M-0; Ingeniero Agronomo, Catholic Univ. of Mar del Plata, 1968; M.S. Cornell Univ., 1971; Fields: Farm Mgt. & Prod. Econ., K, F; Res: Beef Cattle Cost Prod.; Lang: Eng. 1,1,1.

CLASSIFICATION OF MEMBERS ACCORDING TO FIELDS OF SPECIALIZATION

The fields included in the questionnaire are listed below. Members were requested to indicate, in the order of their interest, not more than four fields. In the classification which follows members are grouped according to their first choice of field. Second, third and fourth fields are indicated by letters following the names.

- | | |
|--|--|
| () A. Farm Management & Prod Econ | () G. Statistics & Methodology |
| () B. Agricultural Marketing | () H. Econometrics |
| () C. Agricultural Prices | () I. Economics of Food & Nutrition |
| () D. Agricultural Finance & Credit | () J. World Agricultural Production & Trade |
| () E. Land & Water Economics
Conservation & Devel. | () K. Economic Development |
| () F. Agricultural Policy | () L. General Economic Theory |

FARM MANAGEMENT & PROD. ECON.

Aanderud, Wallace G. DEF	Beneke, Raymond R.	Buxton, Boyd M.
Abukishk, Bakir A.M. EFK	Bennett, H. Grant HG	Byers, Douglas M. EFC
Ackerman, Joseph EF	Berry, John H. FCG	Byers, George B.
Acton, Robert W. EG	Billingsley, Ray V. KLF	Caglar, Metin KEG
Adolph, Dale D. BEK	Birowo, Achmad T. KHG	Callahan, Edgemond P. FD
Ahmed, Muddathir A. JKL	Bitney, Larry L. D	Cameron, Charles H. LK
Ahrenholz, James R. DE	Blackie, Malcolm J. EBD	Campbell, Joe R. BFJ
Ahrens, Curtis LaVerne KBJ	Blanchard, Henri-Paul FKJ	Carlin, Thomas A. KFL
Aines, Ronald O. BJK	Boehlje, Michael D. DG	Carlson, Gerald A. ELH
Akillimali, Bonaventure KCB	Bogle, T. Roy	Carson, Edward E. DF
Allbaugh, Leland G. KE	Bone, Harold M. DBJ	Carter, Harold O. FGK
Allen, George C. B	Boykin, Calvin C. Jr. EJK	Carver, Robert D. DBF
Allen, Herbert R. D	Bradford, Garnett L. GFH	Casler, George L. F
Allen, Stephen Q. DCF	Bradford, Lawrence A. DFJ	Catey, John A. DBC
Ananikas, Loukas J. GEF	Bradshaw, R.C. CDG	Chamberlain, Bryce B. DCF
Anderson, Arthur W. BCJ	Brant, William L. F	Chambliss, Roger L. Jr. BK
Anderson, John R. HL	Bratton, Charles A. DK	Chao, Ching Yuan DGH
Anderson, Ronald A. KFD	Brink, Lars	Charron, Ernest C. FK
Araji, Ahmed A. BKH	Brints, Norman W. D	Chiang, Ying-Chih HGL
Armstrong, David L.	Britney, John B. D	Choudhury, Parimial CBG
Armstrong, James F. BCD	Brock, Donald E. JBF	Christensen, Lee Allen EDG
Arroyo-Castellanos M. BDE	Brodnay, Henry Doss Jr. DGL	Clarke, James W. BFK
Ashraf, Muhammad EH	Brokken, Ray F. F	Clifton, Ivory D. KDE
Aune, Henrik J. BD	Brooke, Donald L. BCD	Cochran, James R.
Aylsworth, James Q. BCF	Brown, Dean A. DFL	Coffman, George W. JB
Bache, David H.	Brown, R. Edward, Jr. DCL	Colyer, Dale K. KE
Bailey, Warren R. D	Brown, Thomas G. DEF	Conklin, Frank S. EKL
Baker, Chester B. DKG	Brown, William G. HEG	Conneman, George J. Jr. DFK
Baker, Richard H.	Browning, Wilmer C	Connor, Larry J. EDL
Ball, Aldon G. FD	Brueck, David A. DB	Cooper, James R. FDB
Baquet, Alan E. EH	Brunk, Max E. CB	Craddock, William J. DFB
Barast, Gabriel G. JLG	Bucher, Robert F. DBF	Circkman, Chlorus W. GL
Bare, B. Bruce G	Buck, Robert K. F	Criswell, James E. D
Barker, Randolph	Bucy, John I. BD	Crossmon, Bradford D. BKJ
Barlow, Frank D. Jr. BLJ	Buddemeier, Wilbur D. KB	Crouch, Robert M. FBC
Barriga, Claudio KBF	Buller, Orlan H. GFL	Crowley, Virgil E. DEF
Barry, William M. F	Bunch, Hildred G. CFD	Cummins, David GHL
Bateman, W. Lanny DBF	Burkhart, G.W. FEL	Cunningham, Clarence H. BJD
Bayda, William M. FGE	Burlingame, Burt B. DBJ	Cunningham, Lowell C.
Beasley, Lynn W. EKD	Burns, James A. FCE	Curtis, Samuel M. DFE
Beck, Frank V. EFB	Bursch, William G. BGC	Cuskaden, Charles M. DFG
Becker, Manning H. D	Butler, Bayford D. D	Cutie-Tula Jesus A. BKL
Beer, Charles L. FD	Butler, Charles P. FDG	Cuykendall, Charles H. BDE
Bell, Sidney C. D	Butterworth, Keith JG	Dailey, Richard T. FGD

Day, Lee M. FKG
 DeAnzelis, Lucio
 Dean, Gerald W. KEF
 DeBenedictis, FGL
 DeIvo, Herman W. DLF
 Dillon, John L. HKF
 Donaldson, Graham F. KDG
 Doneth, John C.
 Doster, Daniel H.
 Dufresne, A.N. KDF
 Durost, Donald D.
 Duvick, Richard D. D
 Dyck, Diedrich EKG
 Ecker, George A. DB
 Edmonson, Vance W. EKL
 Eichers, Theodore R. B
 Eidman, Vernon R. EDG
 Eisgruber, Ludwig M. DGE
 El-Saadi, Mohamed A. GKE
 Elterich, Joachim G. HLG
 Engene, Selmer A.
 Epp, Abram W. DE
 Erickson, Duane E. FKJ
 Erven, Bernard L. FJ
 Evans, James A. DEK
 Eyvindson, Roger K. FH
 Falusi, Abiodun O. HF
 Fan, Charles C. GHL
 Farmer, Charles M. FEL
 Fellows, Irving F. EIG
 Ferell, Raymond S. EGB
 Ferguson, Walter L. BC
 Fife, LaVon S. BGF
 Filan, Stephen J. F
 Finley, John C. BFG
 Flaskerud, George K. DLH
 Florea, Bruce A. DF
 Florez, Vicente BG
 Fox, Austin S. CFH
 Frazier, Thomas L. B
 Frederickson, Dennis R. DBC
 Freeman, Billy G. FDG
 Frick, George E. EB
 Fuller, Earl I. HGF
 Fulton, Craig V. ELG
 Gamble, John C. DBE
 Garland, Clark D. DFE
 Garrett, James R. EB
 Gavett, Earle E. J
 Genereux, Douglas G. BK
 Giaever, Harald B. G
 Giles, Theodore FCK
 Gill, Paul A. FBD
 Gilliam, Henry C. Jr. FBK
 Giuan, William D. CDL
 Glim, Robert J.
 Golden, William I. DF
 Good, Darrel L. EG
 Goodall, George E. EFJ
 Gordon, John P. DBC
 Grant, Walter V. FDK
 Gray, R.C. JFD
 Greene, Robert E.

Greer, James D. DCB
 Grise, Verner N. GFL
 Gustafson, Ronald A. B
 Gustafsson, Bengt. G
 Guthrie, Thomas L. GHB
 Guy, William D.
 Hagan, A.R. DEK
 Halbrook, Waymon A.
 Halter, Albert N. HGK
 Hamilton, Henry G. BCK
 Hammond, John R. K
 Hancock, Curtis R. Jr. DLJ
 Handschin, Robert FJC
 Hansen, Peter L. JFK
 Hardaker, John B. KGI
 Harlan, Reginald K. KBD
 Harms, Alfred G. DK
 Harner, James P. GHI
 Harrington, David H. HLK
 Harrison, Gerald A. GFL
 Harsh, Stephen B. BL
 Harter, Gary D. BG
 Harter, Walter G. D
 Harwood, Dewey G.
 Hasbarger, Paul R. CD
 Hatch, Ray E. DF
 Haugse, Lars FG
 Hayhurst, France Timothy D
 Heagler, Arthur M. FKL
 Hedges, Trimble KFD
 Hedley, Douglas D. KG
 Heid, Walter G. FB
 Hein, Charles H. Jr. DEC
 Helfinstine, Rex D. E
 Helmers, Glenn A. FLG
 Henderson, Philip A. DBF
 Henshaw, Douglas M.
 Hepp, Ralph E. DBF
 Herbst, John H. D
 Hesselbach, Josef L. GH
 Hinton, Royce A. E
 Hodges, Earl F. E
 Hoff, Frederic L.
 Hoffman, Randall A. KF
 Hogland, C. Raymond DEJ
 Hole, Erling CGL
 Holt, John G. DEF
 Howell, Herbert B. D
 Howell, James D. KJL
 Hubbard, John W. FEK
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 Huffman, Donald C. EDB
 Hughes, Harlan G. K
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 Hutton, Robert F. DGL
 Hyer, Edgar A.
 Iga, Masaaki HGE
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 Jefferies, Gene L., BKD

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 Johnson, K.V., DBL
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 Kearl, Willis G. ECB
 Keeler, Joseph T., BKG
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 Kloster, Larry D. EDF
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 Kraenele, C.A. DH
 Krofta, Raymond LK
 Kumpe, John O. BDF
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 Lagrone, William
 Laird, Roy D. FJ
 Lambert, Leland HK
 Lance, George C. BCD
 Langemeier, Larry HCG
 Lanpher, Buel, CFD
 Larriison, Jim KL
 Lawrence, John A. EDF
 Lee, Deane, EDI
 Lee, George E. G
 Lee, Jeung H. KGC
 Lee, John Edward, Jr. DFK
 Justritz, Fredrick, HFE
 Lessley, Billy, DLG
 Lin, William W. KBH
 Lin, Wu-Long, GHJ
 Lindeborg, Karl H. EGH
 Liner, Hugh L. DLK
 Little, Thomas W. FKL
 Loftsgard, Laurel, EF
 Loomis, Clifton W. D

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 Love, Harold C. GDK
 Lovell, Ashley C. BCL
 Lovering, James, E
 Loyd, Harold J. L
 Lu, Chung-Chi, FBK
 Lubischer, Patrick, BD
 Luft, Leroy D. D
 Lybecker, Donald, FKE
 McAlexander, Robert, KJ
 McArthur, Wilmoth, FBK
 McBride, William, DFE
 McCauley, Orris D. EGL
 McClatchy, Donald, KJL
 McInerney, John HGL
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 Miller, Thomas A. FG
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 Moore, Charles V. EK
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 Moore, John E. DF
 Moore, R. D. FDI
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 Morris, Wilford H. KD
 Mueller, Allan G. DF
 Mueller, Robert G. BJE
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 Nicolai, Phillip J. DCB
 Nielson, James, DFK
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 Osburn, Donald D. FKL
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 Pawson, Walter W. FEC
 Penn, J.B. FH
 Perkins, George R. GHC
 Perrin, Richard K. L
 Perry, Robert E. DE
 Petersen, Ralph E.
 Petersen, Thomas A. KFB
 Peterson, Gustof JDG
 Petit, Michael J. KHF
 Petritz, David C.
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 Pickler, Eugene B. BL
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 Plaunt, Darrel H. FKG
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 Pretzer, Don D. BCF
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 Schaefer, Joseph H.
 Schaffner, Leroy W. BE

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 Schmisser, Wilson,
 Schneeberger, Kenneth C. KED
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 Scofield, William, DEB
 Scott, John T. Jr. KG
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 Shahbazi, Ismail, FIK
 Shaudys, Edgar, ED
 Sheffield, Leslie, EBJ
 Shen, Raphall, KFL
 Shipley, John L. EJK
 Shugars, Owen K. FL
 Shumway, Charles R. KL
 Situa, Derli, JK
 Simpson, James H. Jr. DCE
 Sims, Fay M. D
 Sindt, Roger P. DFE
 Sittler, Harry G. FK
 Sitterley, John H. E
 Sjo, John, KJI
 Skold, Melvin D. FEJ
 Smith, Daniel B. FDE
 Smith, Donald G. DE
 Smith, Edward J. K
 Smith, F.U. D
 Smith, Lawrence N. DKF
 Smith, Richard B. FGH
 Smith, William P. DLF
 Sobering, Fred, FKD
 Sonntag, Bernard H. GHD
 Spencer, Dunstan, BK
 Sprott, J. M. GBH
 Spurlock, H. C. DBC
 Stanton, Bernard F. JGF
 Stanton, Lynn A. DLG
 Starbird, Irving, LFD
 Steichen, Joe C. FDB
 Stevens, Delwin M. F
 Stoecker, Arthur L. GH
 Stoneberg, Everett, DCB
 Stovall, John G. FBJ
 Strom, Jay L. JK
 Sturgess, Neil H. GHF
 Stutt, Ralph A. E
 Suter, Robert C.
 Sutherland, Joseph G. DBC
 Swanson, Earl R. E
 Tan, Bock Thiam, BFK
 Taylor, Reed D. BGH
 Taylor, Robert W. BFK
 Tefertiller, Kenneth, KF
 Telwar, Gul M. BGJ
 Thomas, Dennis Lee, HBF
 Thomas, Kenneth H. D
 Thompson, C. EL
 Thompson, William N. FKJ
 Tinnermeir, Ronald L. JEK
 Tinsley, William A. DLF
 Toben, George E.
 Toussaint, William D.
 Trede, Larry D., DBC

Tremblay, Raymond, JLB
 Trirweiler, John E., BC
 Trost, Robert W. DF
 Tyner, Fred H. KH
 Uhe, Ronald E. BCJ
 Umberger, Dwight DGB
 Underwood, Floy BCK
 VanArsdall, Roy N. B
 Vezyroglou, Ioannis, ABF
 Vidal, Manual KJ
 Vincent, Warren H. JK
 Vollmar, Glen V. FLK
 Wahi, Purushotam, LHB
 Walch, Herbert EF
 Walker, Charles N. DBC
 Walker, Odell DLG
 Wegenhoft, Kenneth N. DLJ
 Wehrley, James DFG

Weisgerber, Pius, FGJ
 Wells, James A. BKL
 Wells, Robert C. D
 Welsch, Delane E. FKJ
 Western, Charles W. BE
 Whatley, Thomas J. FDJ
 Wheeler, Richard O. GJH
 White, James H. GL
 White, Thomas K. KG
 Whittlesey, Norman K. EG
 Wicks, John E. DLF
 Wetgreffe, Walter H. DE
 Wiggins, Edward R. DF
 Wilcox, Walter W. DEF
 Wildermuth, John LGD
 Wilken, Delmar, DBC
 Willett, Gayle S. BD
 Williams, Marvin R. BED

William, M.S. IFK
 Wills, John E.
 Wingert, Robert E.
 Winram, James M. BD
 Withers, Russell V. EB
 Woolf, Willard F. DC
 Workman, Herman E. DBF
 Wright, N. Gene BK
 Wright, Karl T. K
 Wright, Paul L. DJB
 Wright, Philip A. DF
 Wysong, John W. BE
 Yang, William Y. JEK
 Yeutter, Ray KF
 Zegers, Prado B
 Zepp, Glenn A. F
 Zoral, Kutlu Yasar, C
 Zurberti, Carlos A. KF

AGRICULTURAL MARKETING

Abbott, John C. DIK
 Abrahamsen, Martin A.
 Ackley, Richard, CGH
 Adams, Kendall A. KJ
 Aguillard, Wilbur, C
 Amann, Victor F. DK
 Anderson, Bruce L. J
 Anderson, Dale G. K
 Anderson, Donald, JFC
 Anderson, Robert W. LGJ
 Angus, Robert C. GH
 Antonides, Robert J. KCF
 Appleton, Peter L. FHD
 Armbruster, Walter J. IGF
 Armstrong, Jan, CDF
 Aspelin, Arnold L. CGL
 Athmer, Jan H. CD
 Ault, Donald E. HCG
 Babb, Emerson M. FG
 Badenhop, Merton B. JK
 Bagnied, Mohsen A. JKL
 Baker, Allen J. CH
 Baker, Ralph L. A
 Ballinger, Roy A. CF
 Banks, Quentin D.
 Baritelle, John L. ALG
 Barton, David G. KLE
 Bates, John D. GFL
 Baumel, C. Phillip, K
 Baumer, Elmer F. ICF
 Baumgart, Paul A. GL
 Beaton, Norman J. ADF
 Beck, Robert L. CG
 Becker, Clare A. A
 Beiter, Robert J.
 Belden, Stanford A. IL
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Gray, Frederick D. LKG
Gustafson, Albert W. BFL
Gutierrez, Jose S. DBA
Hammill, Anne E. ED
Henry, William R. AB
Herrmann, Robert O. BH
Hienstra, Stephen J. BG
Hutson, Willie S. CB
Ives, Russell BC
Lanahan, Thomas J. GBE
Longhurst, Richard W. K
Marion, Donald R. BL
Marshall, Joseph BJA

Nicholson, Robert H. BCL
Prato, Anthony A. BHC
Raunika, Robert BCG
Redelmeier, W. Robert BEK
Rizek, Robert L. FCA
Robbins, L.W. G
Simmons, Emmy B. KG
Simonds, Lois A. BF
Stafford, Thomas H. BG
Swope, Daniel A. B
Vastine, William T. BK
Williams, Joel S. BCE
Zoller, Richard B. BCA

WORLD AGRICULTURE PRODUCTION & TRADE

Andersen, Stephen O. ILK
 Araya, Peter A. KGI
 Bachman, Kenneth L. KFA
 Bale, Malcolm D. KAE
 Bale, M.D. FA
 Barse, Joseph R. FBK
 Bawden, D. Lee F
 Benson, James M. BF
 Boceta, Vin-ente BCF
 Boyer, George K. FKE
 Brinegar, George K. KBD
 Brown, G. Stanley F
 Brown, Lester R. KIF
 Buck, Wilbur F. BF
 Carter, Richard D. DKL
 Christensen, Raymond D. KFA
 Cohen, Marshall H. FIK
 Collins, Hilda C.
 Crockett, Samuel L. EDK
 DeBoer, Alvin J. KAF
 Depping, C. Duane KAF
 Dirks, Harlan J. FK
 Dow, J.K. KFG
 Drummond, Harold E. EKF
 Elaasar, Sammy E. GBE
 Eley, Cleveland P. BCI
 Elz, Klaus D. DK
 Farnsworth, Helen C. FIK
 Goodall, Charles W. IKE
 Hall, Howard L. ABK
 Hillman, Jimmie S. FBK
 Hopper, William D. KFE
 Horbaly, William BAF

Horst, James R. FB
 Hutchinson, John E. KAB
 Hyson, Charles D. KFB
 Karpoff, Edward FC
 Koeller, Harold L. BFK
 Koenig, Nathan FBJ
 Kost, William E. FLB
 Lattimore, Ralph G. GLH
 Law, Dana K. FCB
 Leikind, Hyman JGB
 Lemon, Isaac E. EAK
 Long, Mary E.
 Luney, Percy R. LAE
 McArdle, Richard C. EK
 McGrann, James M. KBC
 Jackie, Arthur B. KFG
 Macomber, Alvin Z. CKB
 Marx, Robert E. AFE
 Mason, Kenneth R. FIG
 Molster, Hendrik AK
 Moncure, Robert C. FKB
 Moore, John R. BKE
 Murphy, Wm. M. KL
 Myers, Maxwell S. FKA
 Naive, James J. BKG
 Nohre, Carmen O. FCA
 Nightingale, Ray W. BIC
 Olson, Robert E. IFK
 Onishi, Haruo LEH
 Packard, Ross L. EGF
 Paris, Tirso B. Jr. KFL
 Parker, John B. Jr. KBI
 Parker, L.M. JEK

Payne, William F. FKB
 Pike, Calrence E. KBF
 Pope, Fletcher, Jr. KBF
 Posada, Alvaro KAB
 Richter, Joseph J. BCF
 Roenigk, William P. BEF
 Rojko, Anthony S. HKF
 Ruff, Samuel O. KFL
 Samson, Glenn R. KAF
 Scandizzo, Pasquale L. KH
 Schaub, John R. KFG
 Schertz, Lyle P. FK
 Schmidt, Stephen C. CFK
 Schwenger, Robert B. FLG
 Shefrin, Frank KF
 Simpson, James R. KAB
 Smith, Mervin G. KFD
 Snodgrass, Milton M. KB
 Sorenson, Vernon L. FB
 Swegle, Wayne E. FK
 Takayama, Takashi LGA
 Tardite, Secondo P.
 Tetro, Robert C. KIL
 Thomasson, Larry F. BFK
 Thompson, Robert E. KHE
 Tontz, Robert L. EKF
 Truesdale, Roger W. DAB
 Vandepuize, Joseph M. CBD
 Vankai, Thomas A. KF
 Volmar, Gustavo S. LCE
 Waldeck, Tom B. BCF
 Warley, Thorald K.FBK
 Willett, Joseph W. KFI
 Winner, Elmer B.

ECONOMIC DEVELOPMENT

Abbadi, Karrar A. FAD
 Abel, Martin E. FCJ
 Ablasser, Gottfried HD
 Abshier, George S. FEB
 Adams, Dale W. DF
 Agrawal, Babu Lal FDA
 Aitken, Percy G.
 Allegre, Daniel E.
 Al-Shaikhly, Fahih A. JHL
 Al-Zand, Osama JFB
 Ames, Glenn FLJ
 Anderson, Marvin S. LJF
 Anderson, Robert LEI
 Andrew, Chris O. BJF
 Anshel, Kurt R. EBI
 Arnold, Adlai F. EAF
 Asfaw, Tsegaye AFJ
 Ayer, Harry W. LJH
 Bachmura, Frank T. FE
 Back, William B. ELG
 Bahr, John J. EJ
 Baker, Forrest
 Baker, John A. EDFL

Barkley, Paul W. EL
 Barry, Robert D. LJH
 Baucom, William B. FL
 Baum, Emanuel L. EJI
 Baur, Roger L. B
 Becker, John A. JBE
 Beebout, Harold S. GH
 Beers, Howard W.
 Behrman, Jere R. HJ
 Bellinghausen, Robert P.
 Beltran, Gregorio JAF
 Bender, Lloyd D. E
 Benito, Carlos A. FHL
 Bennett, Rupert L. BGJ
 Berry, James E. E
 Bethke, Klaus W. FEA
 Bierman, Russel N. DA
 Bills, Nelson L. F
 Bird, Alan R. FL
 Bird, David
 Bird, Ronald DE
 Bjorlie, Wayne E. JDE
 Blackmore, John FEA

Blase, Melvin G. EJF
 Boehm, William T. LFB
 Bottum, John S. FEA
 Brainard, Lawrence J. FLH
 Brannon, Russell A. JEF
 Brinkman, George L. JF
 Bronzi, Piero AF
 Brough, Owen L. AFG
 Brown, David W. JFA
 Brown, Loyd C. JAE
 Brown, Richard N. Jr. EJF
 Burke, Ronnie L. ELB
 Burris, Anthony E. BCG
 Butler, Edward J. JL
 Byerlee, Derek R. AH
 Cammack, William T. J
 Carruthers, Garrey L
 Carruthers, Ian D. AEJ
 Chiang, Tze I. BG
 Chong, Kwong-Yaun LFG
 Chuang, Lih-Hsiung HJG
 Clayton, Kenneth C. EFJ
 Cleave, John H. IFA

Clodius, Robert L. BL
 Coltrane, Robert I. LGF
 Connor, John M. IFL
 Coots, Herman W. FBE
 Cordes, Sam M. FE
 Crecink, John C. ELA
 Crown, Robert W. FHL
 Cusumano, Vincent BHD
 Daft, Lynn M. EFI
 Dalrymple, Dana JIB
 David, Abraham S. LJB
 Davis, Carlton G. JFL
 Davis, L. Harlan DEJ
 Davis, Lloyd H. EAB
 Dawson, John A. F
 Dean, Tom A. BJE
 Deaton, Brady J. JEF
 Debertin, David L. HF
 Degn, Arne M. EFA
 Denney, Everett W. JLD
 DePass, Rudolph LGH
 Detering, Stanley G. ALF
 Dillman, Buddy L. L.
 Doeksen, Gerald A. IEL
 Doerst, John A. JIE
 Doherty, Neville J. GHL
 Domike, Arthur L. FE
 Donald, Gordon Jr.
 Donovan, Walter G. HE
 Dorner, Peter P. EFA
 Dougan, Riley S. EFI
 Duff, Jack B. AEF
 Eckert, Terry B. AFE
 Eddleman, B.R. LEA
 Egbert, Alvin C. FH
 Eichberger, W.G. AEF
 Eldridge, Eber F.
 Erickson, Donald BLG
 Erickson, E.L. EAH
 Evenson, Robert E. JLH
 Ewart, W.M. CBL
 Falcon, Walter JFL
 Faris, Jesse E. ADL
 Farler, Carl
 Feaster, J. G. BIJ
 Fedeler, Jerry A. LF
 Feltnet, Richard L. BDL
 Fender, Frank A. JAF
 Fienup, Darrell F. JB
 Fischer, John L. FDB
 Fitchett, Delbert A. EFL
 Fletcher, Robert R. BE
 Folkerts, William T. IJ
 Folz, Willia, E. FB
 Fontenot, Dwight P. FDG
 Forsht, R.G. ELG
 Fox, Marshall D. JB
 Fraase, Ronald G. BL
 Framingham, Charles F. GFA
 Free, William J. CBA
 Freebaten, Donald K. EF
 Freeland, Mark S. FGL

Freivalds, John JBE
 Fuller, Theodore E. E
 Gehr, James F. DAB
 Gittinger, J.P. JE
 Glover, Loyd FE
 Goering, Theodore J. FJC
 Gordon, John G. AG
 Gorham, J. Mike FJ
 Gotsch, William P. BF
 Green, Bernal L. AE
 Gregersen, Hans M. EFL
 Gregory, Wade F. JAF
 Hammond, David H. L
 Hammond, Jerome J. EG
 Hancock, Nancy LJE
 Hanrahan, Charles E. JGL
 Hansen, David E. EF
 Hanson, Ivan R. EF
 Hardin, Lowell S. JFA
 Harris, E. JD
 Harvey, William E. FJ
 Hayami, Yujro LF
 Haythorne, George FJA
 Heer, John F. JFE
 Henderson, Harold A. EFJ
 Hendrix, William E. FJ
 Herdt, Robert W. FG
 Herrmann, Louis F. BCF
 Hicks, William W. LI
 Hines, Fred K. IFL
 Hoffnar, Bernard FGH
 Holmes, Oliver W. E
 Hoover, Herbert
 House, Alvin E. EF
 Huang, Yukon FAE
 Huie, John M. F
 Hyslop, John D. BF
 Inflanger, Craig L. ELF
 Jackson, Anthony A. LI
 James H. Brooks, JBA
 Jansen, E.F. JEB
 Janseen, M.R. AFD
 Jellema, Bouwo J
 Jetton, Thomas C.
 Thunjhunwala, Charat JAH
 Johns, Ray M. EG
 Johnson, Lawrence E. LAD
 Johnson, Eherman E. FA
 Johnston, B.F. FJI
 Jones, Lonnie L. BHG
 Jordan, Max F. IAG
 Joseph, Robert D. FLH
 Juers, Linley E. EI
 Julius, Marvin G. HG
 Kampe, Ronald E. FJL
 Kanada, Hiromitsu JLH
 Kanel, Don E.
 Kao, Charles LJ
 Karr, Gerald L. DA
 Kellogg, Charles E. FG
 Kellogg, Earl D. GH
 Khan, Mahoodaasan EL

Kilbourn, Arthur G. L
 King, David FED
 Kislev, Yoav AL
 Klayman, M.I. BFL
 Knight, Dale A. ALG
 Kocher, James E. F.
 Kofi, Tetleh A. CGB
 Konyha, Marvin E. FLJ
 Korzan, Gerald E. BCF
 Kottke, Marvin W. HLA
 Krause, Stanley F. B
 Kriesberg, Martin BJ
 Kriesel, Herbert C. FJB
 Kroph, J. Joe AB
 Kue, Leslie T.C. FE
 Lambie, Wayne FBA
 Langley, Leon
 Lanham, William J. BAF
 Layton, Elbert T. EBD
 Layton, M.R. LGE
 Lee, Robert E. JBI
 LeTe, Uma J. JHB
 LeRay, Nelson L. EFD
 Long, Donald E. FL
 Loomis, Ralph A. FJE
 Luykx, Nicolaas FJI
 McArthur, J.W. ABL
 McClish, Gale A. ABG
 McCorkle, Robert E. ABD
 McCoy, Edward W. EG
 McDowell, George EAF
 McElroy, Robert C. DFA
 McElveen, J.V. AEF
 McKinsey, James W. Jr. LBF
 McMillan, Wendell M. B
 McPherson, Woodrow W. LFJ
 Mackey, R. Bruce FL
 MacPherson, Donaron D. BJE
 Maffucci, Eugenio A. HJG
 Mandell, Paul T. EH
 Manning, Richard C. HAF
 Martin, Calvin L. J
 Martin, John V. FLJ
 Martin, Marshall A. JLI
 Matthews, Joseph C. I
 Mellor, John W. FCL
 Mennem, Gary M. BGA
 Menzies, Meril W. FJL
 Mercer, Lloyd J.L.
 Merrill, William C. LBH
 Meyer, Richard L. FD
 Milk, Richard G. FE
 Mills, John H. EA
 Mills, Neil B. LG
 Minms, Otho L. FA
 Mitchell, Glenn H. LGB
 Montgomery, George FJC
 Morgan, Howard E. FBE
 Morgan, Larry C. JAE
 Morrow, Robert B. E
 Mosher, Arthur T.
 Motheral, Joe R. FEC

Mseka, Leonard, JLE
 Mudahar, Mohinder LFH
 Muller, Jurgen, FAL
 Myers, Herman L. BI
 Myers, John K. FJE
 Myrick, Delbert JA
 Nakamura, James I. F
 Neely, William V. FEA
 Nelson, G. Lawrence HBC
 Nelson, James R. ELH
 Nelson, Michael EFA
 Nicholls, Wm. H. IFB
 Nichols, Andrew J. FJ
 Nixon, John FEB
 Obermiller, Frederick GBL
 Ochala, Peter E. FDA
 Okurume, Godwin E. FLH
 Olsen, Duane
 Olson, Carl E. AF
 Omar, Hanai A. JLG
 Otitoju, Ezekiel O. L
 Pagoulatos, Angelos EJJ
 Pallangyo, Ephata P.
 Parker, Wm. N. A
 Parks, Loren L. JI
 Pasca di Magliano JAL
 Patton, John E. L
 Peacock, David L. B
 Pearson, Scott R. JI
 Penny, David H. GAJ
 Pervis, Dennis W. LJB
 Philipp, Perry F. AB
 Pinstrop-Andersen D. FB
 Plath, Clarence V. JEF
 Pulver, Glen C. FAE
 Purvis, Malcolm J. JAI
 Rachal, Joseph V. EHI
 Radtke, Hans D. EF
 Ramalhede, Castro FHB
 Rask, Norman ADF
 Rasmussen, Wayne D. F
 Redfern, J. Martin EH
 Reutlinger, Shlomo FAH
 Reyers, Pedro F. GDL
 Ringlien, Wayne R.
 Robinson, R. Wayne BCF
 Rogers, Walter B. LBF

Rose, Gordon D. EFA
 Ross, James E. JBF
 Roumasset, James A. LJI
 Ruttan, Vernon W. JFA
 Samper, Rafael O. FBL
 Sarkar, Shyamalendu BGL
 Schaller, W. Neill, JFA
 Scharlach, Wes
 Schmid, Lester J. AJE
 Schoonover, David M. J
 Schreiner, Dean F. LE
 Schuh, George E. JF
 Schwartz, Michael AJF
 Schweitzer, Harvey J. F
 Scoville, Orlin J. FAE
 Scully, John J. FAD
 Selley, Roger A. HLA
 Seltzer, Raymond E. JBE
 Seymour, William R. BIE
 Shaffer, Ron E. EFA
 Sheppard, Frank W. DBF
 Shillingford, John D. EAG
 Sidhu, Surjit S. AFB
 Simmons, John L. FH
 Simon, Sheldon R. B
 Singh, Inderjit HLG
 Smith, Eldon D. FBJ
 Smith, George F. AJE
 Smith, Sheila M. KJF
 Smith, Stephen M. BFE
 Sorenson, Donald M. FDJ
 Spaeth, David H. BFA
 Srivastava, Uma K. LAF
 Stallings, James L. ALB
 Stam, Jerome M. FL
 Starch, Elmer A. ALF
 Staub, William J. JLF
 Steiner, Herbert H. JAH
 Stevens, Robert D. AFJ
 Steward, Donald D. JDL
 Stitzlein, John N. DAG
 St. Louis, Robert EGB
 Stone, Paul S. ALF
 Strasma, John EFJ
 Summitt, William R. BEL
 Suttor, Richard E. HLB
 Sladek, Stephen A. FJ

Tang, Anthony M. JGL
 Tarafder, Rabiul I. FB
 Thiesfinhusen, William C. EF
 Thompson, John E. FEJ
 Thorbeck, Erik JH
 Tollens, Eric F. FBA
 Trimms, Anthenies E. EJ
 Trujillo, Roldan C. BD
 Tsao, Alan H.Y. LG
 Ulrey, Orion BF
 Umstott, Haven D. JBD
 Unti, James G. BJ
 Valdes, Alberto FLJ
 Vanderziel, Charles J. LJJ
 VanGigch, Francis S. JA
 Vangness, Elmer C. E
 Vaughn, Gerald F. E
 Venezian, Edward L. AJH
 Viana, Manuel-Osorio HLF
 Voelker, Stanley W. EDF
 Wadsworth, Henry A. FE
 Wagner, Melvin M. BLI
 Walker, Olen N. F
 Wampach, Jean-Pierrem ACL
 Ward, William A. ELF
 Warnken, Philip F. JFL
 Weber, Bruce A. E
 Weber, M.T. BIF
 Weidemann, Wesley C. LJ
 Weigand, David JBE
 Wells, Jerome C. FJL
 Wells, Oris V. FIC
 Wessel, Kelso L. JG
 West, Donald A. EIF
 West, Quentin, Mechan JIF
 Wharton, Clifton R. JLH
 Wheeler, Richard G. AEI
 Whitaker, Morris D. EHL
 Wilcox, Robert W. BAD
 Williams, E. Morgan EF
 Willis, Ian R. EFC
 Winch, Fred E. III ALJ
 Witt, Lawrence W. FJG
 Witucki, Lawrence A. FJB
 Womach, Jasper A. EL
 Wright, Arthur L. ELU
 Yew, Pee Teck JF

GENERAL ECONOMIC THEORY

Allwood, James K. GHE
 Baker, J. Weston, KE
 Barnard, Jerald R. KE
 Bartholomew A. Wayne F
 Bauer, Larry Lee A
 Behr, Michael R. BAF
 Bender, F. more E. AG
 Berg, James F. FG
 Bessler, David A. HDE
 Blood, Dwight M. GE
 Boggs, Kenneth B. ABE
 Bolman, Ray D.

Browning, Shirley C. KFE
 Carton, William P. GHK
 Cauchois, W.S. Jr.
 Chastain, E.D. KAG
 Chawdhry, Muhammad A. KAB
 Chisholm, Roger K. AE
 Clark, Wayne W. BK
 Cordrey, John B. GH
 Corley, Edward G
 Craft, Rolif V. FAK
 Curtis, Wayne C. EGK
 Curtiss, Wm. M. IK

Cuthbertson, Andrew G. ABF
 D'Arge, Ralph C. EJ
 Debois, Jean-Marie GFB
 Dennis, Carleton C. FCB
 DeVeau, Burton JFK
 Edwards, Clark GHA
 Elledge, Barry W. BA
 Ewert, Norman J. EK
 Farrish, Raymond JEF
 Ferguson, Joseph D. ADC
 Fernandez AF
 Finley, Robert M. AFD

Fletcher, Lehman B. BK
 Gardner, B. Delworth EK
 Gibbons, James R. GHA
 Giles, Howard C. CF
 Gislason, Conrad GKF
 Golosi, Lloyd F. GKB
 Gossling, William F. HK
 Hady, Thomas F. KDE
 Haessel, Walter KH
 Harris, Thomas D. FKJ
 Heiby, Ernest D. CJ
 Helmberger, John D. K
 Hendon, Robert L. ABF
 Herendeen, James B. FJ
 Hervey, Jack L. JEF
 Hicks, John W. E
 Higgins, James V. HCB
 Hill, Roger P. EJK
 Holland, Robert L. G
 Homen de Melo, F.B. FJK
 Horton, Donald C. FDK
 Hsiao, James C. GCA
 Huffman, Wallace E. KFH
 Hunter, Donald J. AGF
 Hushak, Leroy J. HFE
 Idachaba, Francis S. GFA
 Innen, Loren A. KA
 Jackson, Elmo L.

Johnson, Paul R. HJ
 Johnston, Richard S. CBI
 Kim, Jonghin GHK
 Kipps, Paul H. EJK
 Knop, Donald R. HCB
 Lane, Sylvia HK
 Lee, Jong-Ying HGB
 Lewis, Carl B. ADF
 Libeau, Clayton P. KFC
 Lin, L. Gee-Sun
 Lin, Steven An-Yhi HKJ
 Ling, Kwang-Siung HBG
 Long, Robert B. HEA
 Loyd, Max I. GB
 McClelland, E.D. GH
 McDonald, Vincent, BK
 McDowell, James I. BGF
 McHugh, Helen F.
 Mace, Almon T. DCF
 Matson, Arthur J. EAD
 Maur, Hardal S. KHG
 May, Donald J. FGJ
 Milan, Robert L. GE
 Miller, James P. KG
 Moak, Samuel K. KFJ
 Morrison, Thomas KF
 Nelson, Paul E. BCF
 Nordin, John A. F
 Pasour, Ernest C. Jr. AFB

Peterson, Hans P. GHK
 Peterson, Willis L. K
 Ponder, Henry KB
 Ponder, Homer G. B
 Prigge, G.R. GAE
 Prochaska, F. JB
 Rafeld, Frederick J. AKH
 Raid, Howard D. ADE
 Raney, Russell R. EGK
 Rayner, Anthony J. FHC
 Robertson, Thyrele BFG
 Ryan, James G. AFH
 Sanders, Bernard L. BHG
 Schmitz, Andrew BHJ
 Scobie, Grant M. KHJ
 Sharma, V.V. GKJ
 Smith, Norton CB
 Steen, K.W. GFK
 Street, Donald R. KEG
 Sumner, D.A. HFC
 Thomson, Procter G
 Waldo, Arley D. FK
 Waterstreet, Wm. N. KBJ
 Wetmore, John M. D
 Wilson, Ewen M. JCH
 Wipf, Larry J. JF
 Wu, Craig Chi-Yen HGK
 Wyeth, Peter KE

MAJOR INTEREST NOT INDICATED

Abogunrin, Bambidele
 Abraham, George L.
 Abram, Reinhart
 Abu-Hweij, Burhan S.
 Acker, Darrel L.
 Adkinson, Leslie B.
 Ahmad, Bashir
 Ahu, Sun Sun
 Ajobo, Owolabi
 Aksoz, Ibrahim
 Akl, Maroun
 Albrecht, O.W.
 Alexander, Jack M.
 Alexander, Wm. H.
 Allen, Philip T. Allen
 Allison, John R.
 Allred, David L.
 Alt, Klaus
 Alvarez, Vicente Boceta
 Amen, Dan
 Amin, Mario M.
 Amoafo, Jones G.
 Andah, Emanuel
 Anderson, Fred B.
 Anderson, Reuin
 Anderson, Kym
 Anderson, Mark
 Anderson, Pinstrip
 Anderson, Robert F.
 Anderson, Roice H.

Anderson, W.J.
 Andrade, Jose G.
 Andrews, B.G.
 Andrews, Richard A.
 Andrienas, Paul
 Angus, James
 Aquino, Carlos E.
 Arabiat, Sulaiman M.
 Arantes, Marco A.
 Aravjo, Paulo F.
 Archer, Tom
 Ardito-Barletta, Nicloas
 Armstrong, Jack H.
 Arnold, Fred T.
 Arnold, George W.
 Arny, Charles W. Jr.
 Arthur, W.
 Ashburn, Clifford
 Asher, Ramsinh K.
 Aslam, Muhammad
 Asmelash, Tsegaye
 Assumpaco, Sualdo
 Athanassatos, George
 Atkinson, Jay
 Atkinson, T.E.
 Azevedo, Adierson E.
 Baba, Umaru Muhammad
 Babbar, Madan M.
 Bacha, Joseph E.
 Bacon, A.S.

Bacos, Romeo S.
 Baharuddin, Amir H.
 Bain, Byford W.
 Baker, John D.
 Baker, Kirk
 Bakir, Abu Kishk
 Barmettler, Edmund R.
 Barrando, Nelson A.
 Basit, Abdul
 Batavia, Bala
 Batista, Jorge C.
 Batterham, Robert
 Baumgartner, D. C.
 Baumgartner, H.W.
 Baxter, E. E.
 Bean, Louis H.
 Beazley, Ronald
 Becker, Fred H.
 Beckford, M.L.
 Beeler, Donald H.
 Belaine, Girma
 Bell, David M.
 Bellarmino, Gentro
 Benedictis, Michele de
 Benfredi, Mohamed M.
 Bennett, Myron D.
 Benson, Fred J.
 Benson, Kennet
 Berg, H.A.
 Bergman, Raymond

Bernaris, A.
 Bertranou, Armando
 Besobrasow, A.C.
 Bevins, Malcom I.
 Bieker, Richard F.
 Bieri, Jurg H.
 Biggs, Stephen D.
 Binswanger, Hans P.
 Birbeck, W. H..
 Birke, Lakew
 Bishop, Richard C.
 Bitting, Wayne
 Bix, Ira N.
 Black, J.A.
 Blatch, P.
 Blakeley, Ransom A.
 Blakeslee, Bill
 Blanco, Jorge O.
 Blanco, Manuel M.
 Blanding, Lincoln
 Blank, Uel
 Bluestone, Herman
 Blum, Martin A.
 Bocchetto, Roberto
 Bodenhamer, H.G.
 Bodenhamer, S. H.
 Boer, John De
 Boisuert, Richard N.
 Bond, Maurice C.
 Boon, Tunnis De
 Booth, J.R..
 Borlin, Max
 Bottum, J. Carroll
 Bowen, Clarence C.
 Bowring, J.R.
 Boyet, Wayne E.
 Bradley, Frank
 Bradley, John G.
 Braithwaite, W.M.
 Bramford, Greg
 Brandao, Erly D.
 Brandt, Karl
 Brantley, Bill
 Brasher, J.A.
 Bredo, William
 Brewer, Michael F.
 Brooks, T.L. Jr.
 Brooks, Wm. F.
 Brooks, Willie T. Jr.
 Brose, Vernon A.
 Brown, A.A.
 Brown, Ernest E.
 Brown, Herbert
 Brown, Lauren H.
 Brown, Wm. A.N.
 Brucher, Maurice H.
 Brunort, Pier Giovanni
 Bryant, W. Keith
 Bucholz, Hans Eberhard
 Buck, J. Lossing
 Buck, John T.
 Buckingham, R.E.
 Buena Ventura, Richard

Buff, Joseph A.
 Bufton, Ere E.
 Bull, Leonard L.
 Bull, Robert K.
 Bullion, George W.M.
 Bullock, Bruce
 Bunkers, William
 Burke, Gerald M.
 Burke, Marguerite C.
 Burnham, Bruce D.
 Burns, David J.
 Bursongsikul, Olsakdi
 Burton, Wayne E.
 Burunah, Hirmet
 Burwell, Thomas J.
 Buwule, Joseph M.
 Buxton, Stephen R.
 Buzarbarua, I.M.
 Bye, Bruce W.
 Byergo, Keith M.
 Callaghan, John F.
 Cameron, Dort A.
 Camp, Samuel G. III
 Campbell, Blair
 Campbell, George W.
 Canady, John D.
 Canto, Wilson Leite do
 Carlisle, Robert
 Carlson, David A.
 Carncross, John W.
 Carroll, Thomas F.
 Carrasco, Alfredo
 Cartwright, R.W.
 Chandler, J.A.
 Chapman, Duane
 Charland, Andre
 Charter, Linton W.
 Chen, Chi-Tiau
 Chen, David Yi
 Chen, Shih Koon
 Cheng, Taio-Shui
 Chicoine, David
 Chien, Ying-I
 Ching, Shun S.
 Christensen, Kent
 Christian, W.E.
 Christianson, Dell
 Chung, Hoon Bo
 Clark, Carl M.
 Clark, Lewis E.
 Clark, J.H.
 Clark, John
 Clarke, D.A. Jr.
 Clarke, J.G.
 Clayton, Larry B.
 Clement, S.L.
 Coddling, Charles H. Jr.
 Coffey, Frederic A.
 Coffey, Lennie R.
 Coffing, Arthur
 Cohee, M.H.
 Coley, Basil G.
 Collings, Gerald W.

Collins, George G.
 Collins, Norman R.
 Connolly, Chan
 Conolly, Ladjane
 Coppersmith, Robert L.
 Corbridge, Ivan L.
 Cormack, John M.
 Cornish, B.J.
 Cosgrove, Michael H.
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 Davis, Irving F. Jr.
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 Davis, K.C.
 Davis, M. Leroy
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 Dawson, Robert H.
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 Delgado, Enrique C.
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 Dempsey, John A. Jr.
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 DeWever, Rose M.
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 Doran, Samuel M.
 Dorling, Michael J.
 Dorsett, Howard R.
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 Driscoll, James L.
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 Dunn, Terry
 Dwumfuoh, Paul
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 Early, John O.
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 Edwards, Richard J.
 Edwards, W.F.
 Egido, Garrido
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 Elliott, F.F.
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 Engler, Joaquim J.
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 Erickson, Arval L.
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 Ferguson, David K.
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 Flint, Wm. R.
 Ford, Er in C.
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 Foytik, Jerry
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 Frederick, Allen L.
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 Freeland, Joseph W.
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 French, Charles E.
 Frick, Franklyn
 Friend, Reed E.
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 Fulcher, Glen D.
 Fuller, C.E.
 Fuller, Varden
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 Furniss, I.F.
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 Garcia, Jose B.
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 Gardner, Ira L.
 Gardner, Kelsey B.
 Gardner, Mark L.
 Garnett, Ed
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 Gilchrist, Varge
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 Gillaspie, Richard L.

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 Giri, Jaya Ram
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 Gomez-Manzanaraes, Emilio
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 Goodman, Richard J.
 Goodwin, Joseph B.
 Goodwin, J.D.
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 Gordon, Ja
 Grady, J.C.
 Graff, Johannes de
 Graham, J.D.
 Grant, Winston W.
 Granelle, Harry M.
 Gray, Edward C.
 Gray, Robert E.
 Gray, S. Lee
 Gray, Wm. H. III
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 Green, Warren J.
 Greenberg, Binnett
 Greene, Brooke A.
 Greene, Wallace R.
 Greenhalgh, Richard A.
 Greenleaf, George G.
 Guellow, Craighton N.
 Guiman, Joseph F.
 Gunn, T. Campbell
 Greenman, J.R.
 Gregory, James C.
 Griffin, Wade L.
 Griffing, Milton E.
 Grimbale, R.
 Groenueid, Doowe R.
 Guroff, Ajram E.
 Gustafson, Robert L.
 Gwyer, George D.
 Haas, John T.
 Hacker, Robert F.
 Hackett, Bruce A.
 Hadley, N.S.
 Haffert, Wm. A. Jr.
 Hague, Terry
 Haldeman, E.N. III
 Haley, Eugene V.
 Hall, Carl R.
 Hall, Howard L.
 Hall, James T.
 Halperin, Haim
 Halvarson, Lloyd C.
 Hama, Mary Y.
 Hamilton, Thomas E.
 Hamlin, Edmund T.
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 Hammerburg, D.O.
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 Hand, William A.
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 Harasany, Peter
 Haregwein, Mamaru
 Harmon, Charles P.
 Harper, Walton W.
 Harrington, J.F.
 Harris, Arthur F.
 Harrison, A.H.
 Hartwig, R.T.
 Hasan, Muhammed Ali
 Hash, Charles T.
 Hatesohl, Delmar E.
 Hathorn, Scott Jr.
 Havelka, Joseph F.
 Havlicek, Joseph
 Hawkinson, Arthur E. Jr.
 Haynes, Lawrence W.
 Heel, Olman
 Heidt, Anthony A.
 Hein, Norlin A.
 Hemmi, Kenzo
 Henderson, Peter L.
 Henke, G.W.
 Henry, Donald L.
 Hernandez, Francisco J.
 Hertsgaard, Thor A.
 Hess, Carroll Vernon
 Hickman, Roy D.
 Higgins, Patrick J.
 Hildebrand, John R.
 Hildebrand, Peter E.
 Hill, F.F.
 Himes, Glenn C.
 Hines, Charles A.
 Hinman, Herbert R.
 Hinton, Troy W.
 Hiroshige, Herbert M.
 Hirsch, Donald F.
 Hirsch, Edith
 Hirsch, Werner Z.
 Hiser, Michel L.
 Hitchener, Roger E.
 Hoag, W. Gifford
 Hoagland, William
 Hobson, Karl
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 Hoffman, Fred
 Hoffman, Linwood A.
 Holderness, James S.
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 Hollowell, E. Graham
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 Holt, James S.
 Holz, Alan E.
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 Honore, Wm. H.
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 Hooker, E.N.
 Horne, James E.
 Hostetler, John E.

Hottel, James B.
 Houck, James D. Jr.
 Hough, Franklin S.
 Howlett, Albert
 Hoyt, Richard C.
 Huambachano, Jaime
 Hudson, Horace E.
 Hughes, Frederick A.
 Hummels, Kenneth R.
 Huq, A.K. Fazlul
 Hurt, Berryman R.
 Hutaboraf, Panturi
 Hutcheson, Aaron A.
 Hutchinson, John D.
 Hyman, L.G.R.
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 Ihman, Buis T.
 Irwin, H.S.
 Ishikawa, Kiyoharu
 Islam, A.K.M. Serajul
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 Jarvesoo, Elmar
 Jeddi, Abdellaziz
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 Jensen, Howard C.
 Jensen, Robert B.
 Jere, Young J.S.
 Jimenez, Guillerma
 Johl, Sardara S.
 John, M.E.
 Johnson, Eugene
 Johnson, Glen Jr.
 Johnson, Richard L.
 Johnson, V. Webster
 Johnson, Wm. Frederick
 Johnston, David L.
 Jones, Douglas M.
 Jones, Elwood C.
 Jones, J.H.
 Jones, Ronald W.
 Jones, William W.
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 Jordan, Howell R.
 Jordan, Johnny W.
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 Kim, Kwang Hee
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 Kim, Se-Yeul
 Kim, Sung Hoon
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 Kinsey, Bill H.
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 Kizer, Lennie G.
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 Kloth, Donald
 Knox, W.D.
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 Krumme, Richard
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 Kuo, Leslie T.O.
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 Ladd, Richard A.
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 Larson, Adlowe
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 Laubis, Robert E.
 Leathers, Kenneth L.
 Leath, Mack N.
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 Lee, Kyung Won
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Lindner, Robert K.
 Lindsey, Quentin W.
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 Litwiller, Wm. F.
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 Lodwick, G.
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 Lunardelli, Antonio
 Luther, H.G.
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 McCauley, Robert S.
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 McCorkle, Chester O. Jr.
 McDonald, Robert
 McDowell, Frank H.
 McGaughey, Stephen E.
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 McGregor, Andrew
 McKeon, John L.
 McKnight, Jene S.
 McKusick, Robert B.
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 McMullin, L.D.
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 Macdonald, Archie B.
 Mackie, Philip
 Macmillan, James A.
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 Madewell, Carl E.
 Magleby, Richards
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 Manano, John B.S.
 Manese, Carlos R.
 Manley, William T.
 Mann, J.S.
 Mann, Thomas L.
 Mann, W. Lowry
 Manning, Travis W.
 Marquis, Duane L.
 Marshall, James P.
 Marshall, Joseph H.
 Marten, John F.
 Marti, Fred R.
 Martinez, Lic G.
 Martinez, Rafael B.
 Mason, Judson P.
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 Meiburg, Charles O.
 Melamed, Abraham
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 Mercker, A.E.
 Meredith, Alan A.
 Meyer, Stephen J.
 Mezger, David C.
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 Miller, Arthur
 Miller, Harold N.
 Miller, Leonard
 Miller, Marlen F.
 Miller, Paul E.
 Miller, Paul J.
 Miller, Stanley F.
 Miller, Waldon T.
 Miller, Walter G.
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 Moe, Lyle
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 Moody, R.E.
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 Moore, Hugh L.
 Morris, Richard
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 Morton, David W.
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 Myers, Kenneth H.
 Myers, Walter M.
 Myles, George A.
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 Nair, K.R.
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 Nayyar, Vincent
 Nefstead, Ward E.
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 Nelson, Kenneth E.
 Nelson, Robert C.
 Nelson, William C.
 Nesius, Ernest J.
 Neuman, Duane F.
 Neumeier, Clarence E.
 Newell, Sterling R.
 Newlin, Kimrey D.
 Nfodjo, S.K.
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 Nightingale, Edmund A.
 Nolasco, Joaquin
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 O'dell, Charles A.
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 Oesterle, E.C.
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 Oliva, Jose O.R.
 Olivares, Felix
 Oliver, James C.
 Onuaha, John N.
 Ortego, Albert J. Jr.
 Oury, Bernard R.P.
 Overley, Frank
 Oweis, Jirvis S.
 Owen, James R.
 Owen, Wyn F.
 Owens, Gerald P.
 Owens, Michael T.
 Owens, Richard W.
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 Padros, Bofias
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 Paris, Quirino
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 Paul, Rodney R.
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 Pederson, Harold C.
 Pedroso, Iby A.
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 Penn, Walter J.
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 Peretti, Heitor O.
 Perrault, Roger
 Peters, C.W.
 Petersen, Errol D.
 Peterson, Earl B.
 Peterson, Jan E.
 Petrie, T.M.
 Petterson, Van G.
 Pfahler, Fritz
 Pfendler, David C.
 Pherson, Vernon W.
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 Phillips, Winston J.
 Pingsun, Shih
 Piper, Daniel G.
 Piracha, Zafar
 Planting, Martin B.
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 Plotkin, Abraham M.
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 Poling, Earl F.
 Pollock, Ronald H.
 Polson, Jim G.
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 Pongsopon, Surapant
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 Porteous, W.L.
 Porter, Kenneth D.
 Porter, Winston D.
 Porterfield, Clyde Jr.
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 Price, Bruce
 Price, Edwin C. Jr.
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 Quantz, Lloyd
 Racham, Thomas S.
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 Reidinger, Richard B.
 Renne, R.R.
 Revzan, M.A.
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 Ricardo, Jose M.
 Richards, Douglas R.
 Richards, Jack A.
 Richardson, Robert A.
 Ricks, Donald J.
 Riddle, Wm. E.
 Rieck, Victor H.
 Rieck, Robert E.
 Riethmayer, Mike
 Riggan, Wilson B.
 Riggs, Fletcher E.
 Rizzi, Pierluige
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 Robbins, George L.
 Roberts, John B.
 Robertson, Scott
 Robinson, Vernon L.
 Roca, Gaston K.
 Rocha, Jober
 Rodewald, Gordon E. Jr.
 Roe, Terry L.
 Rogers, George B.
 Rojas, Jesus L.
 Rollins, Franklin D.
 Roofj, Jan Van
 Rosenthal, Arnold J.
 Ross, Barry L.
 Routhe, Harlund G.
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 Rudberg, Richard C.
 Rudder, Winston R.
 Rufai, Ahmadul
 Rulon, Doyle K.
 Rumsey, Fay
 Runikar, Robert
 Rush, Gary A.
 Rust, Ronald S.
 Ryan, Timothy J.
 Ryu, Byung Seo
 Sackrin, Seymour M.
 Sahasta, Joginder S.
 Sakiura, Seiji
 Salkin, Michael S.
 Samman, Musa
 Sammet, Loy L.
 Sanders, John H.
 Sanders, Parker D.

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 Sargent, Charles
 Sarria, Carlos
 Satucino, Mario A.
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 Saunderson, Mont H.
 Saupe, William E.
 Savage, Job K.
 Saville, R.J.
 Sawyers, Scott
 Saylor, R.G.
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 Schlagel, Melvin
 Schlechty, David L.
 Schneidau, Robert E.
 Schoney, Richard
 Schott, Wm. R.
 Schultheis, Michael J.
 Schultz, Theodore W.
 Schumacher, August
 Schutjer, Wayne A.
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 Schweng, Lorand D.
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 Seasholtz, John D.
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 Sharma, J.S.
 Sharp, Ronald
 Sharp, Wayne W.
 Shaw, David J.
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 Shepard, Herbert E.
 Sherlock, Richard S.
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 Shoemaker, Karl
 Shrestha, Shankar M.
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 Shwedel, S. Kenneth
 Sibold, Don C.
 Silva, Amairton D.M.
 Silva, Paulo R.
 Simcha, Avraham
 Simpson, Glenn D.
 Simunek, Richard
 Singh, Man Mohan
 S-ngh, Ola L.
 Singh, Ranjit H.
 Singleton, Carey B.
 Sirirugsa, Chumnarn
 Sisler, Daniel
 Sison, Raffal A.
 Skok, Richard A.
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 Smith, Charles S.
 Smith, Chester W.

Smith, David L.
 Smith, Dubois T.
 Smith, Glenn R.
 Smith, Jimmy L.
 Smith, R.K.
 Smolen, Gerald E.
 Sneed, Thomas E.
 Snyder, James C.
 Socas, Salvador C.
 Sogn, Arthur B.
 Sokoloski, Adam A.
 Soosa, Wagner
 Soto, Leonel R.
 Southern, John H.
 Souza, Antonio F de
 Souza, Eli de M.
 Spanos, George J.
 Sparks, Stephen O.
 Sparling, Edward W.
 Spaulding, J. Lloyd
 Speicher, John A.
 Spencer, Doyne W.
 Spencer, Leland
 Spurgeon, Martin L.
 Spurlock, Brian D.
 St. Clair, James S.
 Staben, John W.
 Stagno, Horacio Hugo
 Stammer, Richard W.
 Stanikzai, F.
 Stansbury, Dale L.
 Stauber, Martin S.
 Steele, John T.
 Steen, Dwight
 Steiger, Carlos E.
 Steinberg, Lionel
 Stennis, Earl A.
 Stephens, Kennard O.
 Stevens, Ira M.
 Stewart, Charles L.
 Stipe, Sterling H. Jr.
 Stippler, Henry H.
 Stockwell, Richard E.
 Stoddard, Everett O.
 Stoller, James J.
 Story, David
 Strand, Edwin G.
 Strock, Ralph L.
 Strong, Douglas C.
 Stuckey, H.R.
 Stults, Harold
 Sturdivant, Ronald J.
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 Suh, Jai M.
 Sukonthasit, Varasit
 Sumblin, Martin A.
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 Sutton, Horace
 Sutton, Russell W.
 Suwan, Traipol
 Swank, C. William
 Swann, Tommy J.
 Swenson, Clyde
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 Tannous, Afif I.
 Tauer, Kenneth A.
 Taylor, Donald C.
 Taylor, Earl G.
 Taylor, Stuart M.
 Tebandeke, Frederick E.K.
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 Tellez, Jayier
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 Tennies, Arthur C.
 Terrien, Gerard A.
 Thacker, Glenn H.
 Thiam, Tan Bock
 Thodey, Alan R.
 Thoma, Carl
 Thomas, Wilton B.
 Thomas, Woods
 Thompson, Penn
 Thompson, James W.
 Thomson, Kenneth J.
 Thor, Eric Jr.
 Thorne, James D.
 Thorp, Fred C.
 Thursby, J.W.
 Timmons, John F.
 Timms, Dan
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 Tolley, George S.
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 Townsend, George
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 Trapp, James
 Treakle, Charles
 Trego, Wm. H.
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 Tsimchi, Dan
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 Viles, George L.
 Vilstrup, Richard
 Vlasin, Raymond D.
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 Von Lanken, George
 Wade, Kenny L.
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 Wagner, Joseph P.
 Wallbanger, Harvey
 Walker, David
 Walker, John H.
 Walker, Lewis D.
 Walker, Ollie R.
 Walker, Rod
 Walkup, H.G.
 Wall, Norman J.
 Walter, Alan S.
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 Ward, Edward H.
 Ward, Ralph E.
 Warfield, R.R.
 Warren, Stanley W.
 Watanabe, Yoichiro
 Watkins, Don E.
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 Wegner, Steven E.
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 Wells, Clinton F.
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 Wildeman, M.
 Wilhelm, L.A.
 Wilhelmy, Odin
 Wilkin, John T.
 Williams, Donald B.
 Williams, Earl R.
 Williams, Ed
 Williams, Robert R. Jr.
 Willis, Cleve E.
 Willis, Reed
 Wilson, Lorene
 Wilson, Norman
 Wilson, Thomas A.
 Winston, Joseph
 Woldegiorgis, Getahoun

Won, Duk Joong
Workman, David
Worku, Debebe
Worley, David P.
Wright, Bruce H.
Wright, J.R. Jr.
Wright, Ozell
Yager, Laurence L.
Yamaguchi, Mito Shi ,

Yamashita, M.
Yamashita, Sachiko
Yamauchi, Hiroshi
Yaw, W. H.
Yee, Harold T.
Yost, Larry E.
Yotopoulos, Pan A.
Young, Douglas L.

Young, Harold C.
Youngstrom, Ann L.
Youngstrom, C.O.
Yousif, Salah A.
Zegge, Barnabas K.
Zerihoun, Tamrat
Zimmer, John M.
Zimmerman, Ronald D.
Zimmerman, William A.

GEOGRAPHICAL LIST OF INDIVIDUAL MEMBERS

NORTH AMERICA
UNITED STATESAlabamaAuburn

Bell, Sidney C.
Blackstone, John H.
Chastain, E.D.
Clonts, Howard A.
Curtis, Wayne C.
Danner, Maurice J.
Huddleston, Norman
Keen, Robert C.
McCoy, Edward W.
Maddox, Charles L.
Stallings, James
Strawn, Harry B.
Street, Donald R.
Sumblin, M.A.
White, Morris
Wilson, Lowell E.
Yeager, J. H.

Florence

Davis, A.C.
Madewell, Carl E.
Walkup, H.G.

Huntsville

Carlisle, Robert
Mirakhor, Abbas
Wu, Craig Chi-Yen

Muscle Shoals

Ahrens, Curtis L.
Aune, Henrik J.
Free, William J.
Henderson, Harold A.
Mueller, Robert G.
Smith, Wesley G.
Wells, James A.
Woodworth, Roger C.
Young, Harold C.

Montgomery

Moberly, Howard D.

Normal

Ponder, Henry

Sheffield

Clement, S.L.

University

Drake, Albert E.

AlaskaCollege

Burton, Wayne E.
Lin, Peter C.
Thomas, Wayne C.

Juneau

Gazaway, H.P.
Stevens, Ira M.

Palmer

Marsh, Charles F.

ArizonaBuckeye

Shepard, Stephen S.

Phoenix

Reidhead, R. D.

Sun City

Slagsvodd, Peter

Tempe

Becker, R. James
Parker, L. M.

Tucson

Ahmed, Muddathir A.
Akilmali, B.
Amaya, Heriberto A.
Angus, Robert C.
Archer, Tom
Armstrong, J.F.
Ayer, Harry W.
Bessler, D. A.
Boster, Ronald S.
Campbell, George W.
Depping, C. Duane
Elliott, F.F.
Firch, Robert S.
Fischer, John L.
Box, Roger W.
Gotsch, William P.
Hakim, Osman A.
Hammond, John R.
Hathorn, Scott Jr.
Hillman, Jimmie S.
Kalantar, Jamal
Kelso, Maurice M.
King, David A.
Knorr, Philip N.
Layton, Elbert T.

Layton, Melburn R.
Loy, Wei Sun
Martin, William E.
Menzie, Elmer L.
Nelson, Aaron G.
Oswald, Eric B.
Palmer, Charles T.
Pawson, Walter W.
Rollins, Franklin D.
Shaw, Dale L.
Smith, Arthur H.
Stubblefield, T.M.
Swartz, A. Nelson
Tauer, Kenneth A.
Wildermuth, John R.
Wilmont, Charles A.
Wright, N. Gene

ArkansasBlytheville

Bunch, Hildred G.

Fayetteville

Berry, Calvin R.
Bone, Harold M.
Green, Bernard L.
Halbrook, Waymon A.
Malone, Carl C.
Meenen, Henry J.
Morrison, William R.
Price, Carter
Redfern, J. Martin
Spurloch, Brian D.
White, John W.
White, J. H.
Windham, William T.

Little Rock

Atkinson, T.E.
Cook, Neil Ronne
Husa, Melvin C.
Kumpe, John O.
Moore, Clay R.
Patton, John E.
Thiemann, Otto P.
Toon, Thomas G.
Townsend, Thomas W.
Woodward, A.W.

Pine Bluff

Gordon, Ja

State University

Brinkley, Lew E.

Wilmot

Larrison, Jim

California

Brandt, Karl
Bray, James O.
Jamison, John A.
Knudsen, Odin K.
Thoma, Carl

Pomona

Jones, J. H.
McDonald, Russell F.
Martin, John V.
Snodgrass, Milton M.

Riverside

Crocker, Thomas D.
D'Arge, Ralph C.
Harmon, Charles P.
Rock, Robert C.
Wood, William W.

Sacramento

Ellsworth, Heber M.
Freivalds, John
Hansen, William J.
McKusick, Robert B.
Ralph, James T.
Rowell, John D.
Schaffer, Louis C.
Shahbazian, Vernon L.
Storm, Norman D.

San Bernardino

Oliver, James C.

San Francisco

Burje, Ralph B.
Campbell, David C.
Chen, Dean T.
Dyrland, Richard D.
Jeffrey, Kermit C.
Knechel, John A.
Lee, J. Karl
McGregor, Marvin D.
Morrow, Robert B.
Nesius, Ernest J.
Riggs, Fletcher E.
Sawyers, Scott
Sheppard, Frank W.
Viana, Manuel-Osorio
Yee, Harold T.

San Luis Obispo

Davis, M. Leroy
Duarte, Arthur C.
Gatzman, Michael A.
Genereux, Douglas G.
Hyer, Edgar A.
McCorkle, Robert E.

Rogalla, John A.

Santa Ana

Mays, Charles K.

Santa Barbara

Engberg, Russell C.
Goodall, George E.
Mercer, Lloyd J.
Palme, Lennart A.

Stanford

Chuang, Liu-Hsiung
Farnsworth, Helen C.
Fitch, James B.
Gray, Roger W.
Johnston, Bruce F.
Jones, William O.
Khan, Mashal
Kinsey, Bill H.
Kofl, Tetleh A.
Lin, Wu-Long
Mandell, Paul T.
Molster, Hendrick
Muller, Jurgen
Nziramanga, Mudziviri
Pearson, Scott R.
Yotopoulos, Pan A.

Stockton

Clark, Mark E.

Thermal

Steinberg, Lionel

Thousand Oaks

Esmay, James L.

Van Nuys

McMillen, Donald F.
Manese, Carlos R.

Vista

Stippler, Henry H.

Woodland

Leathers, Kenneth L.

Colorado

Boulder

Owen, Wyn F.

Denver

Cone, Marlin R.
Dunn, Terry
Davan, Clarence F.
Glenn, Lowell D.
GueUlow, Craighton N.
Helming, William C.
Moore, Lynn
Myles, George A.
Reirson, Robert J.
Robb, James S.
Rolf, Floyd E.
Talbot, Edward J.
Wymore, Ivan F.

Evergreen

Berger, Robert L.

Fort Collins

Anderson, Raymond L.
Banks, Quentin D.
Bramford, Greg
Gray, S. Lee
Held, R. Burnell
Hildebrand, Peter E.
Kasal, James M.
Madsen, Albert G.
Miuer, Constance
Miller, Thomas A.
Nobe, Kenneth C.
Oakleaf, S. Kenneth
Parsons, Edward G.
Rehnberg, Rex D.
Rohdy, Donald D.
Seckler, David W.
Sitler, Harry G.
Skold, Melvin D.
Sorensen, Donald M.
Tinnermeir, Ronald L.
Walsh, Richard G.
Walters, Forrest E.
Waples, Elliott G.
Young, Robert A.

Lakewood

Collins, George G.

Meeken

Collin, Theodore G.

Pueblo

Bush, Ralph F.

Steamboat Springs

Von Brockdorff, Peter

Albany

Enochian, Robert V.

Bakersfield

Hein, Charles H. Jr.
Hoelscher, Wilfred H.
Hummels, Kenneth R.
Seasholtz, John D.
Spanos, George J.
Viles, George L.

Berkeley

Anderson, Stephen O.
Benedict, Murray R.
Bieri, Jurg H.
Bishop, Richard C.
Boles, James N.
Buchanan, Mark T.
Burlingame, Burt B.
Chern, Wen S.
Clarke, D.A. Jr.
Courtney, Richard H.
Danielson, Leon E.
Debois, Jean-Marie
Doutt, Jeffrey T.
Erdman, Henry E.
Fanucchi, Richard E.
Gill, Gurmukh S.
Gray, Leo R.
Gustafson, Gregory C.
Gustafson, Mark R.
Hoos, Sidney S.
Jost, Richard E.
Kimball, Norman D.
Knox, Philip L.
Kuznets, George M.
Lee, Ivan M.
Lofiting, Everard M.
McCandless, Barbara J.
McGregor, Russell C.
Mamer, John W.
Melamed, Abraham
Moore, John C. Jr.
Owens, Richard W.
Revzan, M.A.
Sammet, Loy L.
Sandor, Richard L.
Scandizzo, Posquale L.
Schickele, Rainer
Schmitz, Andrew
Wallace, Luther T.
Wantrup, Segfried
Wellman, H.R.
Wyeth, Peter W.

Caruthers

Lewis, Charles M.

Castro Valley

Hall, Howard L.

Chico

Dyke, Paul T.
Freeman, Robert E.
Singh, Ola L.

Claremont

Thomson, Procter
Tsukahara, Theodore

Davis

Benito, Carlos A.
Butler, Bayford D.
Carmen, Hoy F.
Carter, Harold O.
Cauchois, W.S. Jr.
Dean, Gerald W.
Dickinson, Thomas E.
Faytlk, Jerry
Freebairn, J.W.
French, Ben C.
Fuller, Varden
Garofan, Leon
Grant, Warren R.
Gustafson, Ronald A.
Hansen, David E.
Hardin, Charles M.
Hedges, Trimble
Horne, Gerald L.
Johnson, Stanley S.
Johnston, Warren E.
Kaneda, Hiromitsu
King, Gordon A.
Lane, Sylvia
Learn, Elmer W.
Llanos, Theodore P.
Lin, William W.
Logan, Samuel H.
McCalla, Alex F.
Meyer, Stephen J.
Minami, Dwight D.
Moore, Charles V.
Niles, James A.
Oliveria, Ronald A.
Paris, Quirino
Parks, Loren L.
Paul, Deane A.
Rausser, Gordon C.
Reed, Addison D.
Reidinger, Richard B.
Rochin, Refugio I.
Ross, Barry L.
Salkin, Michael S.
Snyder, T. Herbert
Sosnick, Stephen H.
Tratz, Robert F. Jr.
Willis, Cleve E.

Fresno

Crouch, Raymond C.
Davis, Irving F. Jr.
Dodds, John P.
Glim, Robert J.
Gunn, Thomas I.
Hagen, John W.
Strantz, Maurice K.

Fullerton

Kuang, Harvey H.
Townshend-Zellner, Norman

Hawthorne

Hilse, Fred C.

Hollywood

Levin, Gerson G.

Huntington Beach

Tater, William J.

Los Angeles

Hirsch, Werner Z.
Jessen, Raymond J.
McKnight, Jene S.
Zawadzki, Michael I.

Menlo Park

Bredo, William
Miller, Clarence J.
Olson, Robert E.

Montebello

Gingerich, Howard

Oakland

Amen, Dan
Baumgart, Paul A.
Been, Richard O.
McCorkle, Chester O. Jr.

Ontario

Thompson, Stanley R.

Orinda

Thor, Eric Jr.

Palo Alto

USAF Academy

Boyer, George K.

Wheat Ridge

Stults, Harold

ConnecticutHartford

Cheney, Philip B.
Doherty, Neville J.
Hammerburg, D.O.

Ledyard

Lamb, Edmund H. II

New Britain

Pae, Ki-Tai

New Haven

Evenson, Robert E.
Hsiao, James C.
Kislev, Yoav
Parker, William N.

New London

Ladd, Richard A.

North Haven

Field, David B.

Stamford

Doak, Thomas E.

Storrs

Allbee, Ronald A.
Booth, J.R.
Brand, John P.H.
Dewey, Arthur W.
Ecker, George A.
Farrish, Raymond
Fellows, Irving F.
Fuchs, Illarius W.
Johnson, Stewart
Kottke, Marvin W.
Kraenele, C.A.
Lee, Tsoung-Chao
Leonard, Robert L.
Ling, Kwang-Siung
Lott, William F.
Nemergut, F.J.
Perregaux, Edmond A.
Schnahel, R.K.
Seaver, Stanley K.

Stitts, Donald G.

Vernon

Charter, Linton W.

Weston

Lewis, Ardron B.

Winsted

Wheeler, Richard G.

DelawareDove

Li, Tien En

Newark

Allred, David L.
Bieker, Richard F.
Cole, Gerald L.
Elterich, Joachim G.
Ginder, Roger G.
McAllister, Willard T.
McDaniel, William E.
Morton, David W.
Nisar, Abdul K.
Pettersen, Van G.
Sladek, Stephen A.
Smith, Dennis K.
Smith, Raymond C.
Toensmeyer, Ulrich C.
Vaughn, Gerald Franklin

District of Columbia

Abel, Fred H.
Ablasser, Gottfried
Abrahamsen, Martin A.
Ackley, Richard M.
Allen, George C.
Andrilenas, Paul
Armbruster, Walter J.
Armstrong, Jack H.
Back, William B.
Bacon, A.S.
Baker, Allen J.
Baker, Gladys L.
Ballinger, Roy A.
Barlowe, Russell G.
Barry, Robert D.
Barse, Joseph R.
Beer, Charles L.
Bellinger, Melvin D.
Beltran, Gregorio
Benfredj, Mohamed M.
Benson, Verel W.
Berg, James F.
Bernitz, Alexander
Berry, John H.

Bethke, Klaus W.
Bierman, Russel W.
Biggs, Gilbert W.
Bird, Alan R.
Bird, Kermit
Bird, Ronald
Blaich, P.
Blum, John C.
Bohall, Robert W.
Boles, Patrick P.
Bond, A. Dewey
Bottum, John S.
Bowser, Max F.
Boxley, Robert F.
Brock, Donald E.
Brooks, Emerson M.
Brooks, Wm. F.
Brown, Dorris D.
Brown, G. Stanley
Brown, Lester R.
Brown, Phillip F.
Brown, Robert C.
Browning, Thomas L.
Buck, Wilbur F.
Burkes, Marshall
Burkett, Wikeith
Burns, Alfred J.
Caldwell, Robert L.
Carlin, Thomas A.
Carr, Alan B.
Cathcart, William E.
Christ, Paul G.
Christensen, Kent
Christensen, Raymond P.
Christensen, S. Kent
Christgau, Victor
Clark, Lewis E.
Clarke, J.G.
Clawson, Marion
Cleave, John H.
Clifton, Ivery D.
Coffey, Joseph D.
Coffman, George W.
Cohen, Marshall H.
Collins, Hilda C.
Coltrane, Robert I.
Cornish, B.J.
Cotner, Melvin L.
Cottam, Howard R.
Cowden, Thomas K.
Crawford, Terry L.
Crickman, Chlorus W.
Crockett, Samuel L.
Crom, Richard J.
Cummins, David E.
Dalrymple, Dana G.
Daly, Rex
Datt, John C.
Davidson, Donald R.
Davis, Bob
Davis, Lloyd H.
Davis, Robert K.
Davis, Velmar W.
Denney, Everett W.

DePass, Rudolph
 Derr, Derl E.
 Domike, Arthur L.
 Donald, Gordon Jr.
 Donald, James R.
 Donaldson, Graham F.
 Doty, Harry O. Jr.
 Droge, John H.
 Duvick, Richard D.
 Duymovic, Andrew A.
 Dwoskin, Philip
 Edman, Victor G.
 Edwards, Clark
 Egbert, Alvin C.
 Eichers, Theodore R.
 Eley, Cleveland P.
 Ellis, Harold H.
 Elz, Klaus D.
 Engleman, Gerald
 Ericksen, Milton H.
 Evans, Carson D.
 Evans, James A.
 Fallert, Richard F.
 Farrell, Kenneth R.
 Feaster, J. Gerald
 Fedkin, John
 Ferguson, Walter L.
 Fitchett, Delbert A.
 Flipse, David E.
 Ford, Richard G.
 Fox, Austin S.
 Fox, Marshal D.
 Fox, Raymond L.
 French, Burton L.
 Gardner, Kelsey B.
 Gavett, Earle E.
 Gehr, James F.
 Gerald, John O'Neil
 Gifford, Claude W.
 Gill, Louis J.
 Gislason, Conrad
 Gittinger, J. Price
 Godwin, Marshall R.
 Gomez-Manzanares, Emilio
 Goodall, Jerry
 Goodman, Richard J.
 Goodwin, Joseph B.
 Graham, Bruce M.
 Grano, Anthony M.
 Grant, J. Richard
 Gray, Frederick D.
 Gray, Robert E.
 Grise, Verner N.
 Grove, Ernest W.
 Guroff, A. E.
 Hacklander, Duane D.
 Hady, Thomas F.
 Hall, Howard L.
 Hall, James T.
 Hammill, Anne E.
 Hancock, Nancy W.
 Handy, Charles R.
 Hanes, John K.

Harrington, David N.
 Harvey, William E.
 Haskell, James E.
 Hedland, Floyd F.
 Heifner, Richard G.
 Helmuth, John W.
 Hendrix, William E.
 Heneberry, William H.
 Henning, Robin G.
 Hesser, Leon F.
 Hienstra, Stephen J.
 Hill, Howard L.
 Hines, Fred K.
 Hoch, Irving J.
 Hodges, Earl F.
 Hoffman, Robert G.
 Hoffnar, Bernard
 Holland, Robert L.
 Holm, Paul L.
 Holmes, Lloyd I.
 Holroyd, William
 Holz, Alan E.
 Hoobler, Sharon Q.
 Hoofnagle, William S.
 Horbaly, William
 Horst, James R.
 Huddleston, Harold F.
 Hughes, Jay M.
 Hunter, Leon J.
 Hutchinson, John E.
 Hutson, Willie S.
 Hyman, L. G.
 Hyslop, John D.
 Hyson, Charles D.
 Jahnke, Donald R.
 Jansen, Melvin R.
 Jesse, Edward V.
 Johnson, Abner L.
 Johnson, Allan S.
 Jones, Douglas M.
 Jones, Lawrence A.
 Jordan, Max F.
 Juers, Linley E.
 Kaiser, Wilson K.
 Kampe, Ronald E.
 Karpoff, Edward
 Kendall, James R.
 Kirkbride, John W.
 Kiser, Harvey L.
 Klumpp, Elmer K.
 Knetsch, Jack L.
 Koeller, Harold L.
 Koenig, Nathan
 Kominus, Nicholas A.
 Kost, William E.
 Krause, Kenneth R.
 Krause, Orville E.
 Krebs, Edward H.
 Kriesberg, Martin
 Kriesel, Herbert C.
 Kromer, George W.
 Kutish, Francis A.
 LaFerney, Preston E.

Lambert, Leland D.
 Lanahan, Thomas J.
 Lanpher, Buel F.
 Lasley, Floyd A.
 Law, Dana K.
 Lea, Dallas M.
 Lee, Alvin T.
 Lee, John Edward Jr.
 Lele, Uma J.
 Lemon, Isaac E.
 Libeau, Clayton P.
 Liu, Charles Y.
 Liu, Su Feng
 Luney, Percy R.
 McArdle, Richard C.
 McCabe, Terrence W.
 McDonald, Vincent
 McElroy, Robert C.
 McGaughey, Stephen E.
 McIlwan, Clara E.
 Mackie, Arthur B.
 Macomber, Alvin Z.
 Maetzold, James A.
 Manchester, Alden G.
 Manning, Richard C.
 March, Robert W.
 Marti, Fred R.
 Martin, Calvin L.
 Martin, Loyd C.
 Marx, Robert E.
 Mason, Judson P.
 Mason, Kenneth R.
 Matthews, Jimmy L.
 May, Donald J.
 Melichar, Emanuel O.
 Mercker, A. E.
 Mighell, Ronald
 Miller, Raymond W.
 Miller, Robert H.
 Miller, Robert R.
 Miller, Walter G.
 Moe, Lyle
 Monroe, Thomas D.
 Morgan, Howard E.
 Moriak, Theodore F.
 Motes, William C.
 Motheral, Joe R.
 Mseka, Leonard
 Myers, Herman L.
 Myers, Mardy
 Myrick, Delbert
 Naden, Kenneth D.
 Naive, James J.
 Neely, William V.
 Nelson, Frederick J.
 Nelson, G. Lawrence
 Nelson, Michael
 Nelson, Paul E.
 Newborg, Michael S.
 Newell, Sterling R.
 Nichols, Andrew J.
 Nikolitch, Raboje
 Nohre, Carmen O.

Ogren, Kenneth E.
 Okurume, Godwin E.
 Otte, Robert C.
 Oury, Bernard R.
 Owens, Gerald P.
 Paarlberg, Don
 Parker, John B. Jr.
 Paul, Allen B.
 Pavelis, George A.
 Peacock, David L.
 Planting, Martin B.
 Podany, Joseph C.
 Pollock, Ronald H.
 Porter, Charles W.
 Porter, Dick L.
 Porter, John T.
 Powell, Jules V.
 Pritchard, Norris T.
 Quance, Calvin L.
 Rader, Lynn
 Rasmussen, Wayne D.
 Ray, Oakley M.
 Reed, Charles E.
 Reinsel, Edward I.
 Reins, Lawrence A.
 Reutlinger, Sitlomo
 Ridler, Duncan
 Riggs, David W.
 Ringlien, Wayne R.
 Robbins, George L.
 Robinson, Bobby H.
 Roenigk, William P.
 Rojko, Anthony S.
 Ruble, William L.
 Rudbeck, James S.
 Ruff, Samuel O.
 Schaub, John R.
 Schluntz, Larry J.
 Schluter, Gerald E.
 Schneider, Vernon E.
 Schnittker, John A.
 Schoonover, David M.
 Schrimper, Richard J.
 Scofield, William
 Seevers, Gary L.
 Seymour, William R.
 Shugars, Owen K.
 Siebert, Jerome B.
 Simpson, Glenn D.
 Slaughter, Rudie W.
 Smith, Allen G.
 Smith, Edward J.
 Smith, Glenn R.
 Sorkin, Martin
 Spencer, Doyne W.
 Stam, Jerome M.
 Stansberry, Robert R.
 Starbird, Irving R.
 Starch, Elmer A.
 Staub, William J.
 Steele, Harry A.
 Steele, Howard L.
 Steele, John T.

Steiner, Herbert H.
 Steiner, Michael P.
 Steward, Donald D.
 Stokes, Edgar C.
 Stokstad, Christian A.
 Strickland, Roger P.
 Strohhenn, Roger W.
 Sturdevant, Tyler R.
 Subat, John Edward
 Sullivan, James D.
 Summers, Larry V.
 Suttor, Richard E.
 Swackhamer, Gene L.
 Swanson, Bruce L.
 Swearingen, Charles H.
 Tharp, Max M.
 Thigpen, James E.
 Thor, Eric
 Thorp, Fred C.
 Tipton, E. Linwood
 Traub, Larry G.
 Trelogan, Harry C.
 Unti, James G.
 Upchurch, Melvin L.
 VanGigch, Francis
 Velde, Paul D.
 Vertrees, James G.
 Volkin, David
 VonOppenfield, Horst
 Walker, Lewis D.
 Walker, Rod
 Wall, Norman J.
 Walsh, Robert M.
 Walter, Bruce J.
 Walters, Harry E.
 Warren, Forest G.
 Weeks, Eldon
 Weil, Robert P.
 Weisgerber, Pius
 West, Quentin M.
 Wetmore, John M.
 Wick, Pascal J.
 Wilkowske, Roger H.
 Willett, Joseph W.
 Williams, Howard C.
 Williams, John R.
 Williams, Sheldon W.
 Winner, Elmer B.
 Wissman, Roger A.
 Witucki, Lawrence A.
 Worden, Gaylord E.
 Wright, Bruce H.
 Wunderlich, Gene Lee

Florida

Bartow

Laurent, Charles K.
 Walker, Charles N.

Cape Coral

Mauch, Arthur

Cocoa Beach

MacPherson, Donaron D.

Fort Pierce

Jenkins, Gerald M.

Gainesville

Alleger, Daniel E.
 Amin, Mario M.
 Andrew, Chris O.
 Bagali, Jagadeu N.
 Boon, Tunnis
 Brodnax, Henry Doss Jr.
 Brooke, Donald L.
 Brooker, John R.
 Brooker, Marvin A.
 Brooks, T.L. Jr.
 Cato, James C.
 Clark, Harold B.
 Conner, James R.
 Connor, John M.
 Covey, Charles D.
 Davis, Carlton G.
 DeBoon, Teunis
 Dow, J.K.
 Eastwood, Ralph A.
 Eddleman, B.R.
 Emerson, Robert D.
 Farler, Carl
 Figueras, Juan
 Gibbs, Kenneth C.
 Gorham, J. Mike
 Greene, Robert E.
 Greenman, J.R.
 Hamilton, Henry G.
 Harris, Gene T.
 Holt, John G.
 Jackson, Elmo L.
 Kiker, Clyde F.
 Konyha, Marvin E.
 Langham, Max R.
 Lee, Jong-Ying
 Lester, W. Bernard
 Liverpool, Leslie
 Long, Donald E.
 McKee, Vernon C.
 McPherson, William K.
 McPherson, Woodrow W.
 Mathis, William K.
 Moxley, Clisby C.
 Myers, Lester H.
 Parker, Arthur F.
 Pearson, James L.
 Polopolus, Leo
 Powe, Charles E.
 Prato, Anthony A.
 Prochaska, Frederick J.
 Reynolds, John E.

Ricker, William D. Jr.
 Rosenberger, Stanley E.
 Ross, James E.
 Samper, Rafael O.
 Smith, Cecil N.
 Smith, Gerald A.
 Spurlock, Alvin H.
 Stafford, Joseph H.
 Tefertiller, Kenneth R.
 Thunjhunwala, Bharat
 Tyner, Fred H.
 Ward, Ronald W.
 Weigand, David K.
 Wilder, Daniel B.
 Williams, Joel S.
 Wyatt, Donna T.
 Zepp, Glenn A.

Miami Shores

Bahr, John J.

Miami

Hernandez, Francisco J.
 Miller, Guy W.
 Rieck, Victor H.

Orlando

Hawkins, Carrol W.

Pensacola

Welsh, Robert S.

Reddick

Hooker, Paul J.

Sarasota

Abraham, George L.

St. Petersburg

Irwin, H.S.

Sun City

Saunderson, Mont H.

Tallahassee

Boutwell, Wallace K.
 Lewis, Timothy T.
 Maier, Frank H.
 Maur, Harpal Singh
 Menasco, Willie T.

Tampa

Norvell, Douglas G.

Georgia

Athens

Brannen, Stephen J.
 Brown, Ernest E.
 Brown, R. Edward Jr.
 Cannon, James W.
 Davies, Yvonne F.
 Ethridge, Melvin D.
 Frazier, Thomas L.
 Givan, William D.
 Glover, Robert S.
 Harter, Walter G.
 Hudson, Horace E.
 Johnson, James L.
 Jones, Harold B.
 Kerns, Waldon R.
 McArthur, Wilmoth
 Moss, Thomas C.
 Nixon, John
 Noles, Richard K.
 O'Kelley, Charles R.
 Raulerson, Richard C.
 Robinson, Vernon L.
 Saunders, Fred B.
 Stanton, Lynn A.
 Thompson, Jack C.
 Trieb, Sykes E.
 Trotter, Warren K.
 White, Freddie C.
 Williams, Floyd W.
 Williams, Marvin R.
 Wise, James O.

Atlanta

Araya, Peter A.
 Chiang, Tze I.
 Dean, Tom A.
 Glover, Glenn H.
 Griffith, Jimmy C.
 Henry, William R.
 Lyle, Cloy V.
 Marshall, Joseph
 Paris, C.W.
 Stout, Roy G.
 Strain, Charles E.
 Sullivan, Gene D.
 Ulvering, Edwin F.

Dalton

Butler, Edward J.

Decatur

McDowell, Frank H.

Experiment

Allison, John R.
 Anderson, Robert F.
 Carley, Dale H.

Harper, Walton W.
 Lance, George C.
 Parvin, David W. Jr.
 Purcell, Joseph C.
 Raunika, Robert
 Runika, Robert
 Smith, Blair J.

Hephzibah

Flaskerud, George K.

Macon

Carlson, David A.

Portal

Lanier, James D.

Tifton

Loyd, Harold J.
 Mikes, Richard J.

Hiwail

Hilo

Hiroshige, Herbert M.
 Marutani, Herbert K.
 Willis, James F.

Honolulu

Anderson, Robert
 Camp, Samuel G. III
 Canfield, Grant W.
 Doue, Stephen M.
 Gertel, Karl
 Gopalakrishnan, Chennat
 Hogg, Howard C.
 Holderness, James S.
 Keeler, Joseph T.
 Kim, Se-Yeul
 Larson, Arnold B.
 Luykx, Nicolaas
 McClish, Gale A.
 Philipp, Perry F.
 Renaud, Bertrand M.
 Scott, Frank S.
 Spielmann, Heinz
 Von Holt, Harry M.
 Wallrabenstein, Paul P.
 Wilson, C. Peairs
 Yamauchi, Hiroshi

Kailua

Peters, C.W.

Pearl City

Hoodenpyle, J. David

IdahoBoise

Catey, John A.
Frazier, George D.
Kennedy, Virgil D.
Robertson, Scott
Youngstrom, C.O.

Moscow

Araji, Ahmed A.
Early, John O.
Folz, William E.
Gilmour, Campbell M.
Godfrey, E. Bruce
Hamilton, Joel R.
Lindeborg, Karl H.
Marousek, Gerald E.
Michalson, Edgar L.
Pratt, Sheldon J.
Sargent, Robert L.
Schermerhorn, Richard
Scholtzko, Ralph T.
Withers, Russell V.

IllinoisArlington Heights

Hirsch, Donald F.
Strong, Douglas C.

Bloomington

Butz, Dale E.
Gardner, Ira L.
Gill, Paul A.
McMillan, Kenneth G.
Matthes, Robert G.

Carbondale

Adams, Kendall A.
Baumgartner, D.C.
Beazley, Ronald
Ewert, Norman J.
Ferrell, Raymond S.
Forrest, William J.
Gustafson, Albert W.
Herr, William
Jobes, Raleigh A.
Keepper, Wendell E.
Lindmark, Richard T.
Lybecker, Donald W.
Miller, Robert E.
Schaefer, Joseph H.
Solverson, Lyle
Trost, Robert W.
Wills, Walter J.

Champaign

Brinegar, George K.
Brucher, Maurice H.
Craven, John A.
Crouse, Earl F.
Stoller, James J.
Hieronymus, Thomas A.

Charleston

Corley, Edward M.

Chicago

Aines, Ronald O.
Arant, Willard D.
Aver, Ivan H.
Barfels, Howard R.
Baughman, Ernest T.
Benjamin, Gary L.
Bentz, Robert P.
Bishop, Willard R.
Brown, Dean A.
Ching, Shun S.
Clark, Robert W.
Collins, Warren
Cox, Clifton B.
Fife, LaVon S.
Hamilton, Robert E.
Hamilton, W.E.
Hatfield, Hollis A.
Hervey, Jack L.
Hildreth, Roland J.
Hitchener, Roger E.
Hood, Kenneth
Huffman, Wallace E.
Hussey, Gorham W.
Johnson, Allen O.
Johnson, David G.
Knepp, Donald Lee
Lekberg, Robert K.
Lenz, R. Britt
Lilly, James P.
Moore, Hugh L.
Nash, Donald G.
Peer, By M.
Quackenbush, Gerald G.
Rao, Musunuru S.
Rudberg, Richard C.
Sayre, William B.
Schaller, W. Neill
Schrader, Frederick M.
Schultz, Theodore W.
Sisson, Phillip F.
Sloan, Roby L.
Smith, Norton
Taylor, James W.
Tolley, George S.
Wang, Yi
Wallin, Lyman W.
Wilkins, G.L.
Zoller, Richard B.

DeKalb

Horton, Donald C.
Oderkirk, Alvan D.
Reiling, Eldon A.

Des Plaines

Matteson, Roger P.

Downer's Grove

Cook, Harlan David

Dunlap

Hurt, Berryman R.

Edwardsville

Lin, Steven An-Yhi

Elmhurst

Dillingham, Robert E.

Evanston

Ray, Randall L.

Galesburg

Yaw, W. H.

Geneseo

Chamberlain, Bryce B.

Great Lakes

Trautwein, Marvin W.

Highland Park

Bix, Ira N.

Ina

Kern, Mark J.

Joliet

Malone, Eugene M.

LaGrange

Dentis, James R.

Lake Bluff

Powers, Mark J.

Lena

Uhe, Ronald E.

Libertyville

Wilhelm, L. A.

Macomb

Chicoine, David
Johnston, David L.
Rogers, Keith D.
Wehrley, James

Makanda

Cammack, William T.

Marion

Becker, Fred H.

Moline

McKee, Dean E.
Ruane, James J.

Normal

Litherland, Richard K.

Northbrook

Hoffman, A.C.

Palatine

Rull, Robert K.

Park Ridge

Keating, Alfred W.

Peoria

Gillaspie, Richard L.

Plano

Hacker, Robert F.

Pleasant Plains

Miller, Harold N.

Roselk

Odak, Perry D.

Springfield

Cross, Albert J.
Moats, Robert H.

Sullivan

Shuman, Charles B.

Sycamore

Mezger, David C.

Urbana

Aylsworth, James Q.
Baker, Chester B.
Brodbeck, Emer E.
Brooks, Bruce L.
Buddemeier, Wilbur D.
Bunker, Arvin R.
Chawdhry, Muhammad Arshad
Chen, Chong-Tong
Davis, Leroy
Davison, Cecil W.
Erickson, Duane E.
Feltner, Richard L.
Fettig, Lyle P.
Gamble, John C.
Gruebele, James W.
Guither, Harold
Halcrow, Harold G.
Harms, Alfred G.
Herbst, John H.
Herd, Robert W.
Hill, Lowell D.
Hinton, Royce A.
Jones, Dewitt
Judy, John W.
Karr, Gerald L.
Kau, Paul
Kellogg, Earl D.
Kelly, Ross A.
Kesler, Richard P.
Kirtley, M.B.
Kliebenstein, James B.
Lee, Kyung Won
Leuthold, Raymond M.
Lins, David A.
Martin, Larry Joe
Martin, Neil Robbins Jr.
Masud, Sharif Md
Moore, Charles L.
Mueller, Allan G.
Mutt, Ralph J.
Narayanan, Adachani V.
Onishi, Haruo
Pandey, R.N.
Parks, Alfred L.
Penson, John B.
Petritz, David C.
Reiss, Franklin J.
Renne, R.R.
Robison, Lindon J.
Roush, James R.
Sands, M.B.
Schmidt, Stephen C.
Schoney, Richard
Schwart, Robert B.
Schweitzer, Harvey J.
Scott, John T. Jr.
Seitz, Wesley D.
Simerol, Lawrence H.

Sims, Fay M.
Sleight, Lynn G.
Smith, Donald G.
Spitze, Robert
Stewart, Charles L.
Stile, Leslie F.
Swanson, Earl R.
Takayama, Takashi
Thomas, Larry C.
Thompson, William N.
VanArsdall, Roy N.
Wagner, Melvin M.
Wahi, Purushotam
West, V. I.
Wilken, Delmar F.
Williams, Moyle S.
Wills, John E.
Wise, Richard L.

Western SpringsIndianaArcadia

Rulon, Doyle K.

Bloomington

Bachmura, Frank T.

Fort Wayne

Bullion, George W.
Drew, John S.
Guthrie, Thomas Lee
Marine, C. Lockwood
Warfield, R.R.

Greensburg

Menkhaus, Dale J.

Hammond

Scharlach, Wes

Huntingburg

Parentenheimer, Ralph

Indianapolis

Juillerat, Monte E.

Lafayette

Anderson, Bruce L.
Armstrong, Jan
Atkinson, Julian H.
Babb, Emerson M.
Bache, David H.
Barton, David G.
Blakeley, Ransom A.

Boehm, William T.
 Bogle, T. Roy
 Bohl, Lawrence P.
 Bottum, J. Carroll
 Brainard, Lawrence J.
 Bursch, Wm. G.
 Butz, Earl L.
 Callahan, John C.
 Candler, Wilfred V.
 Carson, Edward E.
 Clayton, Kenneth C.
 Courtenay, Henry
 Debertin, David Lee
 Doster, Daniel H.
 Downey, W.D.
 Drummond, Harold E.
 Duerwer, Lawrence A.
 Dunbar, John O.
 Dunn, Dennis
 Eisgruber, Ludwig M.
 Emerson, Peter M.
 Erickson, Steven P.
 Ewart, Woralyn M.
 Farris, Paul L.
 Farris, W. S.
 Fender, Frank A.
 Frahm, Donald G.
 French, Charles E.
 Garrett, James R.
 Gordan, John R.
 Graham, J.D.
 Graves, David R.
 Hadley, N.S.
 Haidacher, Richard C.
 Harrington, David H.
 Harrison, Gerald A.
 Havlicek, Joseph
 Hicks, John W.
 Huie, John M.
 Irwin, George D.
 Jones, Bob F.
 Jones, Larry Dean
 Kadlec, John E.
 Kehrberg, Earl W.
 Kepner, Karl
 Kite, Rodney C.
 Knutson, Ronald D.
 Kohls, Richard L.
 Lattimore, Ralph G.
 Lin, Carl Chang-I
 McClatchy, Donald
 Marten, John F.
 Martin, Marshall A.
 May, Ralph D.
 Miller, William L.
 Minden, Arlo J.
 Morris, Wilford H.
 Nelson, Larry L.
 Newell, William F.
 Penn, T. B.
 Pfendler, David C.
 Phillips, Michael J.
 Prindle, Allen M.

Ramalho de Castro
 Richardson, Robert A.
 Robbins, Paul R.
 Robertson, Lynn S.
 Rodes, Robert J.
 Saleh, Abdullah A.
 Sargent, Charles
 Scherr, Bruce A.
 Schrader, Lee F.
 Schuh, George E.
 Schwab, Gerald D.
 Sharples, Jerry A.
 Smith, F. U.
 Smith, Lawrence N.
 Smith, Roland
 Snyder, James C.
 Straszczim, Robert Ed
 Strom, Jay Loren
 Suter, Robert C.
 Taylor, Robert W.
 Tedrow, David G.
 Thomas, Woods
 Thompson, Robert E.
 Uhl, Joseph N.
 Uhrig, John W.
 Valentini, Rubens
 Wadsworth, Henry A.
 White, Thomas K.
 Wilson, Ramon B.

Paoli

Christensen, James E.

Mt. Vernon

Redman, William

Muncie

Brown, Joseph D.

Notre Dame

Cho, Jae Hong

Sullivan

Irwin, Henry

Iowa

Ames

Abogunrin, Bambidele
 Abukishk, Bakir A.M.
 Alexander, Jack M.
 Alt, Klaus
 Arthur, W.
 Bakir, Abu K.
 Ball, Aldon Gordon
 Baumel, C. Phillip
 Bedford, Larry D.

Beneke, Raymond R.
 Caglar, Metin
 Chen, Chi-Jiau
 Crown, Robert W.
 Ditzel, Roger G.
 Doak, Paul D.
 Eldridge, Eber
 Erickson, Eldon L.
 Fedeler, Jerry A.
 Fletcher, Lehman B.
 Fox, Karl A.
 Fuller, Wayne A.
 Fulton, Craig V.
 Futrell, Gene A.
 Gratto, Charles P.
 Harl, Neil E.
 Heady, Earl O.
 Heer, John F.
 Hickman, Roy D.
 Howell, Herbert B.
 James, Sydney C.
 Julius, Marvin G.
 Kaldor, Donald R.
 Kay, Ronald D.
 Kleinman, Alan P.
 Ladd, George W.
 Lu, Chung-Chi
 Madsen, Howard C.
 Magill, William M.
 Mann, Thomas L.
 Martin, Marvin B.
 Maxom, Richard C.
 Mayer, Leo V.
 Medappa, Chottepanda M.
 Merrill, William C.
 Murray, William G.
 Nagadevara, Vishnauprasad
 Nickey, Howard E.
 Nicol, Kenneth
 Ogg, Wallace E.
 Oyindula, Emman O.
 Pagovlatos, Angelos
 Panagides, Dafinis
 Pau, Ian T.
 Paul, Rodney R.
 Paulsen, Arnold A.
 Rahn, Allan P.
 Raikes, Ronald E.
 Rosenberry, Paul E.
 Schellenberg, Herbert D.
 Scott, J.T.
 Shepherd, Geoffrey S.
 Smith, Richard B.
 Sonka, Steven T.
 Srivastava, Uma K.
 Stoecker, Arthur L.
 Stoneberg, Everett G.
 Strain, James R.
 Stuckey, William G.
 Sugai, Yoshihiko
 Talbot, Ross B.
 Thomas, Dennis Lee
 Thomas, Robert W. Jr.

Thomson, Kenneth J.
 Thorbecke, Erik
 Tilley, Daniel S.
 Timmons, John F.
 Tsao, Alan H.Y.
 Tsing, Louis
 Wang, George
 Webster, Henry H.
 Wisner, Robrt N.

Boone

Crall, Terry E.
 Holst, Bertram P.

Burlington

Sutton, Horace

Cedar Rapids

Hammond, David H.

Council Bluffs

Petersen, Errol D.

Davenport

Waterstreet, William N.

Decorgh

Craft, Rolf V.

Des Moines

Brantley, Bill
 Brown, William L.
 Bull, Alvin F.
 Evans, Merrill B.
 Krumme, Richard
 Langer, Ken
 Soth, Lauren K.
 Swegle, Wayne E.

Dow City

Thomas, John W.

Fairfield

Dorsett, Howard R.
 Mogged, Charles C.

Fort Dodge

Acton, Robert W.
 Gray, R.C.

Grinnell

Mosher, M.L.

Iowa City

Barnard, Jerald R.
 Harris, Marshall D.
 Hein, Clair E.

Johnston

Harter, Gary D.

Lamoni

Hough, Franklin S.

Mason City

Kilbourn, Arthur G.

Muscative

Laursen, Marvin P.

Nashau

Link, John

New Hampton

Lesar, James C.

Ottumwa

Ahrenholz, James R.

Sac City

Prentice, Jonathon

Sioux City

Frick, Franklyn
 Trede, Larry D.

State Center

Western, Charles W.

Waukee

Buck, Robert Kenneth

Wever

Lodwick, G.

Kansas

Chanute

Guy, William D.

Colby

Overley, Frank

Fowler

Hildebrand, John R.

Lawrence

Laird, Roy D.

Manhattan

Allwood, James K.
 Baker, Kirk
 Biere, Arlo W.
 Brinkman, George L.
 Buckingham, R.E.
 Buller, Orlan H.
 Coppersmith, Robert L.
 David, Milton L.
 Erickson, Donald B.
 Flinchbaugh, Barry L.
 Frederick, Allen L.
 Hess, Carroll V.
 Jensen, Farrell E.
 Kelley, Paul L.
 Knight, Dale A.
 Koudele, Joe W.
 Langmeier, Larry N.
 McCoy, John H.
 Manuel, Milton L.
 Mennem, Gary M.
 Montgomery, George
 Nauheim, Charles W.
 Niernberger, Floyd F.
 Nordin, John A.
 Orazem, Frank
 Owensby, Raymond M.
 Pine, Wilfred H.
 Pretzer, Don D.
 Schnake, L.D.
 Schoeff, Robert W.
 Schruher, Leonard W.
 Scoville, Orlin J.
 Seltzer, Raymond E.
 Sjo, John
 Sorenson, L. Orlo
 Thomas, Wilton B.
 Trapp, James
 Unger, Samuel G.
 Ward, Clement E.
 Whitehair, Norman V.
 Wissman, Donald

Nickerson

Trostle, Ronald G.

North Newton

Spaulding, J. Lloyd

Overland Park

Grayson, U. Grant
Ose, P. J.

Salina

Atwood, Nova D.

Topeka

Williams, E. Morgan

Wichita

Caviness, Dan J.

KentuckyAlexandria

Crouch, Robert M.

Berea

Johnstone, Robert L.

Bowling Green

Henshaw, Douglas M.

Covington

Smolen, Gerald E.

Frankfort

Dhaliwal, Hardev S.
Saufley, Zach C.

Hopkinsville

Callahan, Steve A.
Jones, Davie R.
VonLanken, George

Lexington

Allen, Stephen Q.
Alton, Charles T.
Anschel, Kurt R.
Beattie, Bruce R.
Beck, Robert L.
Beers, Howard W.
Bobst, Barry W.
Bondurant, John H.
Bordeaux, A. Franklin Jr.
Bradford, Garnett L.
Bradford, Lawrence A.
Brannon, Russell A.
Browning, Wilmer
Burris, Anthony E.
Byers, George B.

Card, Dana G.
Chien, Ying-I
Clark, Carl M.
Criswell, James E.
Cusumano, Vincent
Deaton, Brady J.
Gooch, Ernest D. Jr.
Hall, Harry H.
Hanrahan, Charles E.
Hoff, Frederic L.
Hourigan, W. Wilson
Joseph, Robert D.
Justus, Fred E. Jr.
Loudermilk, Jack L.
Love, Harold G.
Mackey, Everett
Mather, Loys L.
Morgan, Larry C.
Price, Bruce
Price, Edwin C. Jr.
Price, H. B.
Redman, John C.
Roberts, John B.
Robertson, B. Russell
Rudd, Robert W.
Shuffett, D. Milton
Smith, Daniel B.
Smith, Eldon D.
Spaeth, David H.
Stovall, John G.
Sutton, Russell W.
Thompson, C. Stassen
Wallbanger, Harvey
Wilkinson, James Keith

Louisville

Arnold, Lester L.
Henry, Donald L.
Judd, Frank
Ortego, Albert J. Jr.

Morehead

Grinnell, Gerald E.
Morrison, Thomas C.
Wade, Kenny L.

Murray

Giles, Howard C.
Hendon, Robert L.
Martin, James C.

Paducah

Coots, Herman W.

LouisianaAlexandria

Hoffman, Fred

Baton Rouge

Alexander, William H.
Amir, Hussin
Aquillard, Wilbur
Baharuddin, Amir H.
Beasley, Lynn W.
Campbell, Joe R.
Corty, Floyd L.
DaSilva, Derli
Efferson, John N.
Fielder, Lonnie L. Jr.
Francois, C.F.
Freeland, Joseph W.
Gile, Buford M.
Goodwin, J.D.
Guedy, Leo J.
Hargroder, John D.
Heagler, Arthur M.
Hudson, James F.
Huffman, Donald C.
Jindia, Taswant Rai
Johnson, R. Bruce
Klindt, Thomas H.
Law, Jerry McHugh
Mire, Ronald J.
Monroe, James R.
Nelson, Robert C.
O'Carroll, Francis X.
Owens, Michael T.
Paxton, Kenneth W.
Primeaux, Larry E.
Roberson, Ronald R.
Roy, Ewell P.
Salazar, Jorge M.
Schupp, Alvin R.
Traylor, Harlon D.
Wiegmann, Fred H.
Williams, Douglas R.
Woolf, Willard F.

Lafayette

Army, Charles W. Jr.

Monroe

Milk, Richard G.
Watzek, John A.

New Orleans

Anderson, Walter C.
Corkern, Ray S.
Lucas, Ernesto C.
Jacxsens, Peter A.
Pleasanton, Alfred
Wilson, Norman

Ruston

Carothers, J. Edwin
Ponder, Homer G.

MaineCenter Lovell

Howlett, Albert

Fairfield

Elias, Shirley J.

Orono

Benson, Fred J.
 Dephendahl, Johannes
 Dunham, Wallace C.
 Geiss, Wilbert C. Jr.
 Grant, Winston W.
 Harlan, Reginald K.
 Johnston, Edward F.
 King, F. Richard
 Krofta, Raymond N.
 Metzger, Homer B.
 Micka, Edward S.
 Pelsue, Neil H.
 Shehata, Shehata E.
 Tobey, Donald M.
 Wing, Kenneth E.

MarylandAdelphi

Vankai, Thomas A.

Annandale

Clough, Malcolm

Annapolis

Schultz, David A.

Baltimore

Carton, William P.
 Fause, E.G.
 Scoller, William P.
 Sison, Raffal A.
 Strock, Ralph L.
 Sturdivant, Ronald J.

Bethesda

Becker, Joseph A.
 Brandao, Erly D.
 Carroll, Thomas F.
 Curtis, W. Thomas
 Farstad, Edmund H.
 Hirsch, Hans G.
 Knapp, Joseph G.
 Lowenstein, Frank
 Matzen, Edwin H.
 Norris, D.K.

Saco, Alfredo M.
 Strand, Edwin G.

Blandensburg

Hama, Mary Y.

Bowie

Marasco, Richard J.
 Sokoloski, Adam A.

Brandywine

Hooker, E.N.

Chevy Chase

Bitting, Wayne
 Brewer, Michael F.
 Heien, Dale M.
 Koffsky, Nathan M.
 Wilcox, Walter W.

College Park

Arnold, Fred T.
 Bagnied, Moshon A.
 Bellows, William J.
 Bender, Filmore E.
 Bookhout, Bryon R.
 Charbonneau, Joseph J.
 Curtis, John M.
 Dardis, R.
 Dempsey, John A. Jr.
 Foster, Phillips W.
 Hardie, Ian W.
 Hoecher, Harold H.
 Holmes, A. Stewart
 Ishee, Sidney
 Jones, William R.
 Lawrence, Robert G.
 Lessley, Billy V.
 Lyon, Gale H.
 Moore, John R.
 Murray, Ray A.
 Nash, Darrell A.
 O'Mara, Gerald K.
 Poffenberger, Paul R.
 Seyala, Mahmood Y.
 Singleton, Carey B.
 Smith, Harold D.
 Stephens, Kinnard O.
 Tuthill, Dean F.
 Via, James E.
 Vondruska, John
 Walker, William P.
 Won, Duk Joong
 Wysong, John W.

Crofton

Davis, Samuel E.

Savage, Job K.

Dickerson

Wells, Clinton F.

Gaithersburg

Burnham, Bruce D.
 Cavin, James P.

Hyattsville

Beiter, Robert J.
 Chapogas, Peter G.
 Hoecker, Raymond W.
 Keefer, James F.
 Kellogg, Charles E.
 Nystrom, Paul E.
 Ricker, Harold S.
 Rizek, Robert L.
 Runyan, Jack L.
 Sackrin, Seymour M.
 Stelzer, Roland O.
 Swope, Daniel A.
 Taylor, Earl G.
 Yousif, Salah A.

Kensington

Grathouse, Donald R.
 Schwenger, Robert B.

Mt. Airy

Watkins, Don E.

New Carrollton

Rogers, George B.

Olney

Clayton, Larry B.

Owings

Hulse, Fred E.

Oxon Hill

Aspelin, Arnold L.

Potomac

Blum, Martin A.

Prince Frederick

Johns, Ray M.

Riverdale

Stiles, John S.

Rockville

Leikind, Hyman
VanMeir, Lawrence W.

Rossmoor

Callahan, Edgemond P.

Seabrook

Obermiller, Frederick

Silver Springs

Ardito-Barletta, Nicloas
DeValut, Samuel H.
Ford, Erwin C.
Friend, Reed E.
Havelka, Joseph F.
Kue, Leslie T.
Litwiller, Wm. E.
Mackie, Philip
Smith, R.K.

Suitland

Brown, Loyd C.
Franklin, Earl R.

Temple Hills

Wesson, William T.

Waldorf

Mills, John H.

MassachusettsActo

Shepard, Herbert E.

Agawam

Little, Porter C.

Amherst

Al-Shaikhly, Falih A.
Ashraf, Muhammad
Brown, A. A.
Christensen, Robert L.
Crossmon, Bradford Dean
Engel, N. Eugene
Foster, John H.
Jarvesoo, Elmar
Lee, Deane
Lee, Robert E. II
Marion, Donald R.
Payne, Brian R.
Russell, Sargent

Storey, David A.
Tirath, Gupta R.
Vertrees, Robert L.
Washi, N.G.

Boston

Arthur, Henry B.
Bird, David
Craig, Bruce L.
Goldberg, Ray A.
Mann, W. Lowry
Peterson, Byron S.

Cambridge

Falcon, Walter P.
Galbraith, J.K.
Griliches, H. Z.
Lee, Robert E.
Miranowski, John A.
Papanek, Gustav
Simmons, John L.
Wegner, Steven E.

Lexington

Schumacher, August

North Dartmouth

LaPlante, Merritt G.

Norwood

Kinsinger, Kenneth E.

Petersham

Gould, Ernest M. Jr.

Topsfield

Spiller, Donald M.

MichiganBattle Creek

Mawby, Russell G.

Buchanan

Tichenor, Gerald E.

Dearborn

Henning, William L. Jr.

Detroit

Fossum, M. Truman

East Lansing

Ahl, James G.
Ahmad, Bashir
Ajobo, Owolabi
Ananikas, Loukas J.
Armstrong, David L.
Barlowe, Raleigh
Berg, H.A.
Bocchetto, Roberto
Boger, Lawrence L.
Bonnen, James T.
Bradley, John G.
Brake, John R.
Brown, Lauren H.
Bull, Leonard L.
Byerlee, Derek R.
Campbell, Gerald R.
Canto, Wilson Lecite do
Carkner, Richard W.
Carvey, David G.
Charland, Andre
Chong, Kwong-Yaun
Christensen, Lee Allen
Cole, David Lee
Connor, Larry J.
Dickey, Thomas W.
Dike, George K.
Doneth, John C.
Eicher, Carl K.
Ferris, John N.
Fisher, Dennis
Gailey, Donald W.
Good, Darrel L.
Grommet, Allen C.
Gustafson, Robert L.
Harsh, Stephen B.
Hathaway, Dale E.
Hayenga, Wayne A.
Hepp, Ralph E.
Hines, Charles A.
Hogland, C. Raymond
Hondai, Susumu
Hostetler, John E.
House, Alvin E.
Idachaba, Francis S.
Johnson, Glenn L.
Johnson, James B.
Johnson, M.A.
Johnson, Richard L.
Kelsey, Myron P.
Kiene, Werner
Knoblauch, W.A.
Kyle, Leonard R.
Lacy, Keith H.
Lorzeler, Henry E.
Lee, Jeung H.
Lee, Seong Woo
Libby, Lawrence W.
Linsenmeyer, Dean A.
McBride, Glynn
McDowell, George R.
McKeon, John L.

Manderscheid, Lester V.
 Meek, John J.
 Miller, Paul J.
 Miller, Waldon T.
 Montigny, Remi G.
 Nair, Kusum
 Okay, John L.
 Padgitt, Merritt M.
 Paris, Tirso B. Jr.
 Pee, Teck-Yeu
 Perkins, George R.
 Perkinson, Leon B.
 Rhoads, Ronald R.
 Ricks, Donald J.
 Robbins, L.W.
 Rossmiller, George E.
 Sandretto, Carmen L.
 Schmid, A. Allan
 Shaffer, James D.
 Shen, Raphael
 Sherlock, R.S.
 Shwedel, S. K.
 Silva, Paulo R.
 Smith, David L.
 Sorenson, Vernon L.
 Sparks, Stephen O.
 Speicher, John A.
 Steen, K.W.
 Steinmuller, Milton H.
 Stevens, Robert D.
 Stipe, Sterling H. Jr.
 Sumner, D.A.
 Supalla, Raymond J.
 Sutharomn, Bunloe
 Swenson, Clyde
 Tarafder, Rabiul I.
 Jergen, Floyd D.
 Tinsley, William A.
 Torrealba, Pablo M.
 Trimble, Richard L.
 Ulrey, Orion
 Updograff, Gaile
 Vincent, Warren H.
 Vlasin, Raymond D.
 Wadsworth, Bryant H.
 Weber, M. T.
 Wharton, Clifton R.
 Winch, Fred E. III
 Witt, Lawrence W.
 Wood, Garland P.
 Wright, Karl T.
 Zegge, Barnabas K.
 Zehner, Mary D.

Flint

Verwest, Donald E.

Franklin

Cooper, James R.

Holt

Piper, Daniel G.

Houghton

Chao, Ching Yuan

Lansing

Baucom, William B.
 Bodenhamer, H.G.
 Lehker, John N.
 Rauchenstein, Emil
 Stuchman, Noel W.
 Swanson, Glenn A.
 Yeutter, Ray O.

Marquette

Hartwig, R.T.

Okemos

Bell, David M.
 Foster, Harry A.
 Harrison, Kelly M.

Saginaw

Hiser, Michel L.
 Sarkar, Shyamalendu

Troy

Taggart, Richard J.

Ypsilanti

Gibbons, James R.
 Williams, Robert J.

Minnesota

Alexandria

Ross, Lyle M.

Collegeville

Schirber, Martin E.

Crookston

Hoff, David E.

Duluth

Sieffaff, Richard O.
 Vose, David A.

Hector

Nicolaf, Phillip J.

Lake City

Hoyt, Richard C.

Mankato

Kaldenberg, Ronald

Marshall

Schmid, Lester J.

Minneapolis

Arnold, David B.
 Ault, Donald E.
 Crewdson, Gene
 Erickson, Charles E.
 Fuller, C.E.
 Hendel, Julius
 Herder, Richard J.
 Lin, Lizbie Gee-Sun
 Loomis, Sanford K.
 McNeal, C. Dean
 Maiki, Wilbur R.
 Nightingale, Edmund A.
 Schwartz, Donald
 Shoemaker, Karl
 Yates, D. Merold

Morgan

Frederickson, Dennis

Redwood Falls

Sanders, Parker D.

St. Louis Park

Roberts, William L.

St. Paul

Abel, Martin E.
 Al-Zand, Osama
 Anderson, Jonathan D.
 Angus, James
 App, James C.
 Bambenek, Jerome V.
 Berg, Sherwood O.
 Blackmore, John
 Blank, Uel
 Bryant, W. Keith
 Burns, James A.
 Buxton, Boyd M.
 Christiansen, Martin K.
 Christianson, Dell
 Cochrane, Willard W.
 Cuykendall, Charles H.
 Dahl, Dale C.
 Dahl, Reynold P.

DeBoer, Alvin John
 Egertson, Kenneth E.
 Engene, Selmer A.
 Farner, Ben E.
 Fishel, Walter L.
 Fontenot, Dwight P.
 Fruin, Jerry E.
 Fuller, Earl I.
 Geistfeld, Loren V.
 Graham, F. James
 Gregersen, Hans M.
 Griffiths, William E.
 Hammond, Jerome W.
 Handschin, Robert
 Hasbargen, Paul R.
 Hein, Norlin A.
 Helmsberger, John D.
 Houck, James D. Jr.
 Hunt, Robert DeVere
 Jensen, Harold R.
 Jesness, Oscar B.
 Kaushik, Om P.
 Knudtson, Arvid C.
 Koller, E. Fred
 Koszarek, Thomas V.
 Lundgren, Allen L.
 Mahe, Louis A.P.
 Maish, Lynn J.
 Mann, J.S.
 Martin, Lee Roy
 Meilke, Karl D.
 Meyers, Paul J.
 Michael, Allen G.
 Myers, John K.
 Nodland, Truman R.
 Pederson, Harold C.
 Peterson, Willis L.
 Pherson, Carl L.
 Pilgram, E.F.
 Prado, Christian Z.
 Purvis, Malcolm J.
 Raup, Philip
 Roe, Terry L.
 Routh, Harlund G.
 Rutan, Vernon W.
 Ryan, Mary E.
 Sanders, John H.
 Setter, Gerald L.
 Shane, Mathew D.
 Shatava, James W.
 Shelley, Oren R.
 Shim, Young Kun
 Sidhu, Surjit S.
 Skok, Richard A.
 Smith, Frank J.
 Snyder, Robert W.
 Solman, Mestafa A.
 Sundquist, Wesley B.
 Thomas, Kenneth H.
 Waelti, John J.
 Waldo, Arley D.
 Yamaguchi, Mito Shi
 Yamashita, Sachiko
 Zegers-Prado, Christian

Winona

Hanlon, J. Wm.

Mississippi

Greenwood

Sayre, Charles R.

Jackson

Kuntz, Berry Ted

Lorman

Fortenberry, J. W.

Oxford

Cosper, Harold R.

Rolling Fork

Hand, James Jr.

Scooba

Stennis, Earl A.

Starkville

Malone, Gerald W.

State College

Bell, Thomas M.
 Crecink, John C.
 Hurt, Verner G.
 Johnson, Eugene
 Johnson, Lawrence E.
 Jordan, Howell R.
 Phillips, Travis D.
 Seale, A.D. Jr.
 Simpson, James H. Jr.
 Trammell, David L.
 Waldrop, John E.
 Wells, Chester M. Jr.

University

Boyet, Wayne E.

Missouri

Columbia

Baumann, Michael M.
 Becker, John A.
 Bellinghausen, Robert P.
 Bender, Lloyd D.
 Bennett, Myron D.
 Bevins, Robert J.
 Bivens, Gordon E.

Blackie, Malcolm J.
 Blase, Melvin G.
 Bodenhamer, Sachell H.
 Boggs, Kenneth B.
 Breimyer, Harold F.
 Brown, Thomas G.
 Cramer, Charles L.
 DeGraff, Johannes
 Denney, Arthur H.
 Devino, Gary T.
 DeWever, Rose M.
 Doll, John P.
 Eggers, Richard W.
 Fausett, Marvin R.
 Fenwick, Richard S. Jr.
 Finley, Robert M.
 Gillespie, Glenn A.
 Glenn, Robert F.
 Green, Richard D.
 Greenhalgh, Richard A.
 Grimes, Glenn A.
 Hagan, A.R.
 Hassan, Zuhair A.
 Hatesohl, Delmar E.
 Headley, Joseph C.
 Hicks, William W.
 Hoover, Herbert
 Hughes, Harlan G.
 Jacobs, Victor E.
 Johnson, Stanley R.
 Kamendis, Christos T.
 Kiehl, Elmer R.
 Klingner, Clarence E.
 Kroph, J. Joe
 Levi, Donald R.
 McCamley, Francis P.
 McKinsey, James W.
 McKinsey, James W. Jr.
 McNabb, Coy G.
 Meisner, Joseph C.
 Miller, Kenneth E.
 Mortimer, John W.
 Moser, David E.
 Ogut, Cevdet
 Olsen, Duane
 Osburn, Donald D.
 Plank, Stephen C.
 Ratchford, C. Brice
 Rhodes, V. James
 Rottman, Leroy F.
 Samman, Musa
 Schneeberger, Kenneth C.
 Shelley, William V.
 Sievers, Lonnie G.
 Smith, Dwight L.
 Sulieman, Mohammed
 Suphaphiphat, Phiphit
 Taylor, Charles R.
 Torgerson, Randall E.
 VanMeter, Steve K.
 Vickers, Keith R.
 Voss, Leonard A.
 Warnken, Philip F.
 West, Terry G.

Whitted, Stephen F.
Wiggins, Edward R.
Williams, Dorwin L.
Wilson, Lorene
Workman, Herman E.

Fayette

Hileman, Audley E.

Ft. Leonard

Leshner, William G.

Kansas City

Davis, Wm. D. Jr.
Doll, Raymond J.
Driscoll, James L.
Harshbarger, C.E.
Hooper, Jack F.
Leath, Mack N.
Leith, W. Gordon
Perkins, Gene E.
Sanders, Bernard L.
Waldeck, Tom B.

Raytown

Walters, Charles Jr.

Rolla

Ethridge, Don E.
Jenkins, Larry C.

Springfield

Blakeslee, Bill
Smith, J. N.
Spurgeon, Martin L.

St. Joseph

Halldemann, E.N. III

St. Louis

Bunkers, William
Coats, Norman M.
Fisher, James W.
Greer, James D.
Heitz, Glenn E.
Justis, Paul G.
Kloth, Donald
Luttrell, Clifton B.
Obrecht, Kenneth B.
Pederson, John R.
Roberts, Ronald C.
Wilkin, John T.
Worsecck, Raymond A.

Montana

Billings

Degn, Arne M.
Kloster, Larry D.
McDowell, James I.
Ward, Ralph E.
Wicks, John E.

Bozeman

Bucher, Robert F.
Burt, Oscar R.
Cothern, James H.
Cramer, Gail L.
Dudley, Norman J.
George, Earl St. George
Greer, Robert C.
Griffing, Milton E.
Hash, Charles T.
Heid, Walter G.
Holje, Helmer C.
House, Verne W.
Jensen, Clarence W.
Larson, Donald K.
Luft, LeRoy D.
McConnen, Richard J.
Myrick, Dana H.
Peterson, Earl B.
Quenemoen, Merle E.
Stauber, Martin S.
Thompson, Layton S.
Ward, Edward H.
Wheeler, Richard O.
Zimmerman, Ronald D.

Hamilton

Bjergo, Allen

Sidney

Sundsted, Anton S.

Nebraska

Fremont

Lubischer, Patrick

Kearney

Lewis, Carl B.

Lincoln

Anderson, Dale G.
Baker, Maurice E.
Barr, M. James
Bitney, Larry L.
Bucy, John I.
Buenaventura, Richard
Carver, Robert D.
Delvo, Herman W.

Epp, Abram W.
Evans, Bert M.
Fischer, Loyd K.
Flores, Vicente
Frey, Thomas L.
Gerber, Warren W.
Gessaman, Paul H.
Hassler, James B.
Helmert, Glenn A.
Henderson, Philip
Johnson, K.V.
Johnson, Ralph D.
Kendrick, James G.
Lagrone, William F.
Landgren, Norman E.
Lytie, Paul W.
Marquis, Duane L.
Miller, Paul E.
Muelbeier, John
Ottoson, Howard W.
Penner, A.J.
Peterson, Donald L.
Putman, John W.
Rochford, John C.
Schultz, Fredrick H.
Sheffield, Leslie F.
Sorenson, James N.
Vollmar, Glen V.
Voss, Kenneth Ray
Wellman, Allen C.

Mitchell

Ashburn, Clifford

North Platte

Perry, Robert E.

Omaha

Eggers, Herman J.
Jettson, Thomas C.
Jones, Billy H.
Suchomski, Lawrence B.
Sweeney, Robert E.

Nevada

Boulder City

Wagner, Joseph P.

Carson City

Benson, Kennet
Rafsnider, Giles T.

Reno

Anderson, Kevin
Barmettler, Edmund R.
Beeler, Donald H.

Champney, William O.
Detering, Stanley G.
Fitzsimmons, Dave R.
Garrett, James R.
Little, H. Clay
McNeely, John G. Jr.
Malone, John W. Jr.
Paillesen, Raymond M.
Rush, Gary A.
Seuffeele, Charles H.
Workman, David

New Hampshire

Contoolook

Walz, Thomas C.

Durham

Andrews, Richard A.
Bowring, J.R.
Ching, Chauncey T.K.
Forste, Robert H.
Frick, George E.
Glass, Ronald J.
Jansen, Edmund F.
LeRay, Nelson L.
Nott, Sherrill B.

New Jersey

Emerson

Ackerman, George F.

Englewood Cliffs

Eddy, Nelson H.

Jackson

Westcott, Edwin R.

Manasquan

Carnecross, John W.

Morristown

Tagg, Robert J.

New Brunswick

Burns, David J.
Derr, Donn Alan
Grossman, Elliott S.
Koch, Alfred R.
Lee, Woo Bong
Meredith, Alan A.
Stammer, Richard W.

Orange

Greenberg, Bennett

Princeton

Beck, Frank V.
Weymar, F. Helmut

Roosevelt

Goozner, Alan R.

Sea Isle City

Haffert, William A. Jr.

Trenton

Thursby, J.W.

Westfield

Cromarty, William A.
Myers, Walter M.

Whippany

Rosenthal, Arnold J.

New Mexico

Albuquerque

Bendavid, Shaul
Trujillo, Roldan C.
Randall, Stanley

Clovis

Schott, William R.

Las Cruces

Burke, Gerald M.
Canady, John D.
Carruthers, Garrey
Clevenger, Thomas S.
Creel, Bobby Joe
Crider, Richard A.
Dawson, George R.
Fuller, Stephen W.
Gorman, William D.
Gray, James R.
Greene, Charles H.
Haley, Eugene V.
Hall, Carl R.
Hansen, Harry L.
Hanson, Marlin L.
Lansford, Robert R.
Lotham, Roger Dale
McClelland, Edward W.
Myers, Bill D.

Ogaz, Hector H.
Osterhoudt, Frank H.
Ott, Gene O.
Payne, James R.
Demarest, Linda A.
Randall, Alan J.
Seol, In Toon
Stephens, William P.
Stroman, Jack G.
Stuckey, H.R.
Trego, William H.
Vastine, William T.

Portales

Owen, James R.

New York

Albany

Bair, William T.
Hemp, Robert J.

Alfred

Stopper, William W.
Wietgreffe, Walter H.

Ardsley

Bates, John D.
Hunter, Elmer L.

Auburn

Wasserman, Walter C.

Baldwinsville

Smith, Chester W.

Blauvelt

Geyer, Frederick P.

Bronx

Kritz, Solomon

Brooklyn

Chen, Shih Koon

Cobleskill

Wingert, Robert E.

Delmar

Gillett, Roy Lewis

Flushing

Bennett, Rupert L.

Great Neck

Glushieh, R. N.

Hudson

Barry, William M.

Irvington

Curtiss, William M.

Ithaca

Allee, David J.
 Anderson, Marvin S.
 Belden, Stanford A.
 Boisvert, Richard N.
 Boisvert, Richard N.
 Bond, Maurice C.
 Bradley, Frank
 Bratton, Charles A.
 Brown, Earl H.
 Brunk, Max E.
 Call, David L.
 Casler, George L.
 Chapman, Duane
 Conklin, Howard E.
 Conneman, George J. Jr.
 Cunningham, Lowell C.
 Darrach, Lawrence B.
 Doering, Otto Charles III
 Dominick, Bennett A. Jr.
 Donovan, Walter G.
 Drosdoff, Matthew
 Eiler, Doyle A.
 Falkson, Louis M.
 Falysi, Abiodun O.
 Fernandez, Jaime
 Forker, Olan D.
 Fox, Alan
 Freebairn, Donald K.
 Fritsch, Conrad F.
 Girao, Jose
 Goodrich, Dana C.
 Harner, James P.
 Hedlund, Glenn W.
 Hinman, Herbert R.
 How, Richard B.
 Jackson, Geoffrey H.
 Kaltzer, Robert J.
 Kearl, C. Delmar
 Ladue, Eddy L.
 Larson, Olaf F.
 Lenahan, Robert J.
 Linton, Robert E.
 Longhurst, Richard W.
 Loomis, Clifton W.
 Lutz, Edward A.
 Mellor, John W.

Metz, Joseph F. Jr.
 Mount, Timothy D.
 Mudahar, Mohinder
 Myers, William I.
 Oesterle, E.C.
 Padberg, Daniel I.
 Pierson, Thomas R.
 Poleman, Thomas T.
 Robinson, Kenneth L.
 Shahman, Leonard
 Shillingford, John D.
 Sisler, Daniel
 Spencer, Leland
 Stafford, Thomas H.
 Stanton, Bernard F.
 Strang, Daniel R.
 Thacker, Glenn H.
 Tomek, William G.
 Warren, Stanley W.
 Yon, Bernard
 Yousef, Raouf N.
 Zaman, M.R.
 Zulberti, Carlos A.

Londonville

Buff, Joseph A.

Latham

Pedersen, Ronald W.

Long Island

Smith, DuBois T.

New York City

Arnold, Adlai F.
 Arroyo-Castellanos, M.
 Benson, James M.
 Besobrasow, A.C.
 Byergo, Keith M.
 Collins, Norman R.
 Costello, Brian P.
 Davis, L. Harlan
 Dirks, Harlan J.
 Eichberger, Willis G.
 Euler, Roger S.
 Ferguson, Eli H.
 Garber, Norman K.
 Gatty, Ronald
 Hankin, Irving E.
 Goodall, Charles W.
 Hardin, Lowell S.
 Harrington, J.F.
 Hirsch, Edith
 Kazi, Ralph G.
 Klingenberg, Dan A.
 Kocher, James E.
 Krause, Stanley F.
 Lim, Chuan-Chian
 Linstrom, Harold
 Little, Charles H.

Magleby, Richard S.
 Meeker, Brice K.
 Meyer, Richard Lee
 Miller, Leonard
 Mitchell, Glenn H.
 Mosher, Arthur T.
 Nakamura, James I.
 Nyberg, Albert J.
 O'Brien, George W.
 Packard, Ross L.
 Patrick, George F.
 Penn, Walter B.
 Pettigrew, William E.
 Plath, Clarence V.
 Rice, Ted
 Saupe, William E.
 Saylor, R.G.
 Sharp, Wayne W.
 Shumway, Alan G.
 Silverman, Jeffrey L.
 Southern, John H.
 Steen, Dwight
 Thodey, Alan R.
 Tobey, Jonathan S.
 Trick, Alan W.
 Turkish, Norman A.
 Urquhart, Norman R.
 Weisenborn, David E.
 Welch, Finis
 Wilcox, Robert W.
 Ziegler, William J.

Niagara Falls

Baum, Emanuel L.

Oneonta

Baumgartner, H.W.

Ossining

Biedermann, Konrad

Pleasant Valley

Buck, J. Lossing

Rochester

Cameron, Dort A.

Scarsdale

Hill, F. F.
 Wilson, Thomas A.

Schenectady

Gooding, David I.

Seneca Falls

Cunningham, James S.

Smithtown

Luther, H.G.

Syracuse

Charron, Ernest C.
Cross, George R.
Dennis, Carleton C.
Mathis, Joseph C.
Rumsey, Fay
Tennies, Arthur C.
York, John C.

West Davenport

Asher, Ramsinh K.

North CarolinaBoone

Elledge, Barry W.
Mukherjee, Tridib

Carthage

Johnson, V. Webster

Chapel Hill

Field, Alfred J.
James, H. Brooks

Charlotte

Ammerpohl, Henry J.

Columbia

Woodley, Glenn W.

Durham

Gardner, Mark L.
Riggan, Wilson B.

Farmville

May, Robert W.

Gary

Parks, John R.

Goldsboro

Logan, Gary L.

Greensboro

Blanding, Lincoln
Coley, Basil G.

Evans, Sidney H.
Ramsey, Moses H.
Robbins, Richard D.
Robinson, Howard F.
Thorne, James D.

New London

Pickler, Eugene B.

Raleigh

Balfour, B. Burton II
Batavia, Bala
Binswanger, Hans P.
Brooks, Robert C.
Bullock, Bruce
Capel, George L.
Carlson, Gerald A.
Castro, Roberto
Crosswhite, Wm. M.
Dahle, Robert D.
Demald, Fernando H.
Elaasar, Sammy E.
Gardner, Bruce L.
Gilliam, Henry C. Jr.
Handy, Russell P.
Harwood, Dewey G.
Higgins, James V.
Homen de Melo, Fernando
Homme, Henry A.
Hoover, Dale M.
Innen, Loren A.
Ikend, John E.
Jackson, Eugene A.
Jellema, B. M.
Johnson, Paul R.
King, Richard A.
Lindsey, Quentin W.
Liner, Hugh L.
Maddox, James G.
Mangum, Fred A.
Matthews, Joseph C.
Neuman, Duane F.
Nichols, Thomas E.
Nicholson, Robert H.
Pasour, Ernest C. Jr.
Peeler, Ralph J.
Perrin, Richard K.
Proctor, Edwin A.
Pugh, Charles R.
Ryan, James G.
Schrimper, Ronald A.
Scobie, Grant M.
Seagraves, James A.
Shaner, Jackie F.
Shumway, Charles R.
Stone, Paul S.
Suarez, Roberto C.
Sutherland, Joseph G.
Tan, Bock Thiam
Thiam, Tan Bock
Toussaint, William D.
Turner, Aldon A.
Wells, Robert C.

Wilson, Ewen M.

Red Springs

Galbreath, Charles M.

Research Triangle Park

David, Abraham S.
Rachal, Joseph V.
Rulison, Michael von Eltz

Wadesboro

Gatewood, Lawrence R.

Wilmington

Hill, Roger P.
Ward, William A.

Winston Salem

Edwards, W.F.

North DakotaArthur

Zimmerman, William A.

Fargo

Anderson, Dale O.
Anderson, Donald E.
Anderson, Ronald A.
Bjorlie, Wayne E.
Bueling, Merrill C.
Cobia, David W.
Cox, Rex W.
Dorow, Norbert A.
Erlandson, Gordon W.
Fraase, Ronald G.
Helgeson, Delmer L.
Herman, Charles E.
Hertsgaard, Thor A.
Johnson, Jerome E.
Johnson, Roger G.
Krenz, Ronald D.
Leistritz, Frederick L.
Loftsgard, Laurel D.
McDonald, Hugh J.
McMartin, Wallace
Marhatta, Hari P.
Nelson, David C.
Ostenson, Thomas K.
Rice, Billy B.
Schaffner, LeRoy W.
Sobering, Fred D.
Taylor, Fred R.
Thomson, Donald E.
Vaelker, Stanley W.
Vangsness, Elmer C.

Walstad, Donald E.

Portland City

Erickson, Roger W.

Ohio

Akron

Erickson, E.L.
Klayman, M.I.

Alliance

Prigge, G. Ray

Arcanum

Duffy, Thomas

Ashland

Rafeld, Frederick J.

Athens

DeVeau, Burton W.

Bluffton

Raid, Howard D.

Cincinnati

Saathoff, Carl R.

Cleveland

Carter, Richard D.
Chronister, Hugh
Gady, Richard
Khalili, Amir

Columbus

Adams, Dale W.
Baher, Ralph L.
Bailey, Raymond A.
Baker, Richard H.
Barr, Wallace
Baumer, Elmer F.
Baur, Roger Lee
Bowen, Clarence C.
Boyne, David H.
Clayton, Paul C.
Collings, Gerald W.
Cravens, Eugene M.
Dogan, Riley S.
Erven, Bernard Lee
Ezzell, Austin B.
Glover, T.F.
Grimm, Frederick T.
Hadley, Herbert H.

Hahn, David E.
Henderson, Dennis R.
Himes, Glenn C.
Hitzhusen, Fredrick J.
Howell, James D.
Hushak, Leroy J.
Ingraham, Charles H.
Jacobson, Robert E.
Kinne, Ivan L.
Larson, Donald W.
Lee, Warren F.
Long, David R.
McCauley, Orris D.
McCormick, Francis B.
McDonald, Margaret F.
Marion, Bruce W.
Mendel, Joseph J.
Meir, Harvey A.
Miller, James R.
Moore, John E.
Nelson, William C.
Paine, Douglas T.
Rask, Norman
Riddle, William E.
Sharp, John W.
Shaudys, Edgar T.
Shonkwiler, Larry R.
Simon, Sheldon R.
Simonds, Lois A.
Singh, Inderjit
Sitterley, John H.
Smith, Mervin G.
Steiger, Carlos E.
Stitzlein, John N.
Stout, Thomas T.
Taiga, Omo A.
Taylor, Reed D.
Tongate, Ronald E.
Tuan, Chyau
Vandemark, Vern A.
Walker, Francis E.
Watkins, Edgar P.
Wayt, William A.
Wessel, Kelso L.
Westerhold, Raymond W.
Wilhelmy, Odin
Wipf, Larry J.
Zehr, Donald E.

Dayton

Cordrey, John B.
Raney, Russell R.
Royer, Edwin J.

Eaton

Moore, R. Donald

Fairborn

Dickison, William E.

Fostoria

Kerber, Michael J.

Fremont

Wright, Paul L.

Huntsville

Gordon, John P.

Jackson

Smith, William P.

Loveland

Albrecht, O.W.

Mansfield

Sharma, V.V.

Marysville

Poling, Earl F.

North Lawrence

Stoll, Roger J.

St. Henry

Post, David J.

Sunbury

Worley, David P.

Toledo

Klein, Thomas A.

Wapakoneta

Acker, Darrel L.
Miskell, David R.
Polson, Jim G.

Westerville

Swank, C. William

Wilmington

Truesdale, Roger W.

Wooster

Jones, Ted Lee

Worthington

Greenleaf, George G.

OklahomaEdmond

Harris, Allan J.

Marshall

Simunek, Richard

Oklahoma CityCosgrove, Michael H.
Crowder, Richard J.
Smith, Earl B.Ponca City

Steichen, Joe C.

StillwaterAbshier, George S.
Badger, Daniel D.
Bateman, W. Lanny
Blakeley, Leo V.
Boehje, Michael D.
Brant, William L.
Coddling, Charles H. Jr.
Coffey, Lennie R.
Davis, Jim
Davis, K.C.
Davis, Robert G.
Doeksen, Gerald A.
Eidman, Vernon R.
Franzmann, John R.
Goodwin, John W.
Hague, Terry
Hanson, Ivan R.
Harwell, Richard L.
Hatch, Ray E.
Holland, David W.
Horne, James E.
Hummer, Paul D.
Jose, H. Douglas
Kletke, Darrell D.
Lu, Yad-Chi
Mapp, Harry P. Jr.
Maynard, Cecil D.
Morris, Douglas E.
Nelson, Kenneth E.
Nelson, Ted R.
O'Brien, Joseph P.
Ochala, Peter E.
Oehrtman, Robert L.
Parcher, Loris A.
Plaxico, James S.
Purcell, Wayne D.
Rathjen, Robert A.
Ray, Daryll E.Richardson, James W.
Riley, John B.
Roush, Clint E.
Schmedt, Theo F.
Schreiner, Dean F.
Shaffer, Ron E.
Sloggett, Gordon R.
Tubbs, Alan R.
Tweeten, Luther G.
Underwood, Floy Lee
Walker, Odell L.
Walker, Olen Neal
Ward, Houston E.
Wegenhoft, Kenneth N.
Wolff, Noeman C.TulsaAnderson, Fred B.
Doerst, John A.Woodward

Ferguson, Joseph D.

OregonCorvallisAnderson, Frank M.
Baquet, Alan E.
Becker, Manning H.
Bhagia, Gobind S.
Bradshaw, R.C.
Brokken, Ray F.
Brown, William G.
Castle, Emery N.
Conklin, Frank S.
Coppedge, Robert O.
Crowley, William D.
Dawson, Robert H.
Erwin, David E.
Forest, Jacques G.
Gibbs, Christopher
Griffin, Wade L.
Halter, Albert N.
Hammonds, Timothy M.
Holloway, Milton L.
Holmes, Oliver W.
Jaksch, John A.
Johnston, Richard S.
Louroukakis, Stavros
Lynne, Gary D.
McHugh, Helen F.
Miles, Stanley D.
Miller, Stanley F.
Mumford, D. Curtis
Nefstead, Ward E.
Nelson, A. Gene
O'Connor, Carl W.
Pendse, Philip C.
Radtke, Hans D.
Schmisseur, Wilson Ed
Schneidau, Robert E.Shulstad, Robert N.
Stevens, Joe B.
Stoevener, Herbert H.
Teal, Ray Holt
Thomas, Howard R.
Trierweiler, John E.
Vieth, Gary R.
Vesterby, Marlow C.
Wyckoff, J.B.
Youde, James G.
Youmans, Russell C.
Young, Douglas L.Mammoth

Finster, Ronald D.

PortlandAdams, Thomas C.
Green, Warren J.
Hamilton, Thomas E.
Haynes, Warren F.
Peterson, Thomas H.
Wood, William R.SalemLevering, Michael R.
McKinley, Robin D.PennsylvaniaBethlehem

Haldeman, Robert C.

Bloomsburg

Backer, J. Weston

Carlisle

Pherson, Vernom W.

Collegeville

Hunter, Donald J.

GettysburgHurley, Ray
Yager, Laurence L.New Holland

Healey, George E.

PhiladelphiaBehrman, Jere R.
Hand, Paul E.
Jensen, Howard C.

McDonald, Robert
Milan, Robert L.

Pittsburgh

Goetschius, F.W.
Katz, Saul M.
Wells, Jerome C.

Selinsgrove

Brose, Vernon A.

Sharpsville

Bacha, Joseph E.

State College

Hoffman, Linwood A.
Myers, Kenneth H.
Poorbaugh, Richard W.

University Park

Becker, Clare A.
Bennett, Kenneth R.
Birth, A. Kermit
Brandon, George E.
Butz, William T.
Bye, Bruce W.
Carroll, William M.
Crowley, Virgil E.
Curtis, Samuel M.
Daugherty, Arthur B.
Day, Lee M.
Epp, Donald J.
Finley, John C.
Forsht, R. G.
Fuller, Theodore E.
Gamble, Hays B.
Goode, Frank M.
Hallberg, Milton C.
Henson, William L.
Herendeen, James B.
Herrmann, Robert O.
Hoagland, William
Holt, James S.
Hughes, Frederick A.
Hutton, Robert F.
Jansma, T. Dean
John, M.E.
Kelly, B. Wayne
Kizer, Lennie G.
McAlexander, Robert
Madden, James P.
Moore, Harry L.
Neigh, Harold E.
Partenheimer, Earl J.
Pasto, Jerome K.
Schutjer, Wayne A.
Shaw, Charles N.
Stemberger, Anthony P.
Swope, William M.

Trotter, Clarence E.
VanHorn, Thomas G.
Voight, Alvi O.

Upper Darby

Hunt, William

Villanova

Cox, Thomas

Puerto Rico

Rio Piedras

Choudhury, Parimal
Gonzalez, Edgardo
Pringle, George E.

Santurce

Descartes, S.L.

Rhode Island

Kingston

Gates, John M.
Jeffrey, Arthur D.
Norton, Virgil J.
Seay, Edmond E.

Newport

Gould, James S.

South Carolina

Asheville

Browning, Shirley C.

Charleston

McAlhany, John W.

Clemson

Aull, George H.
Butler, Charles P.
Dillman, Buddy L.
Dyer, Carl L.
Golden, William I.
Hite, James
Hubbard, John W.
Lanham, William J.
Lytle, John S.
McElveen, Jackson V.
McLemore, Dan L.
Malphrus, Lewis D.

Miles, James F.
Mizelle, William O. Jr.
Nix, James E.
Pittman, Jarold F.
Pope, Robert M. Jr.
Spurlock, Hooper C.
Steele, William T.
Stepp, James M.

Columbia

Bartholomew, A. W.
Darr, Robert A.

Due West

Loyd, Max I.

Florence

Jordan, Johnny W.

Orangeburg

Londhe, Suresh H.

Parlington

Langley, Leon

Sumter

Morse, Stanley F.

South Dakota

Brookings

Aanderud, Wallace G.
Allen, Herbert R.
Anderson, Arthur W.
Antonides, Robert J.
Benning, Leonard
Berry, Russell L.
Gaarder, Raymond O.
Gilbert, Howard A.
Glover, Loyd
Graham, Ronald C.
Helfinstine, Rex D.
Kohlmeyer, William
Myers, Maxwell S.
Payne, William F.
Rose, Gordon D.
Sogn, Arthur B.
Thompson, John E.

Clark

Murphy, William M.

Ellsworth Air Force Base

Vanderziel, Charles J.

Hot Springs

Staben, John W.

Huron

McMartin, John C.

Pierre

Gibb, Richard D.

Sioux Falls

Muchow, Jeffrey P.
West, Melville B.

Watertown

Folkerts, William J.
Thompson, Penn

Yanktown

Alexander, Eugene B.
Matson, Arthur J.

TennesseeBolivar

Harris, Arthur F.

Brownsville

Giles, Theodore
Sneed, Thomas E.
Stewart, James E.

Clarksville

Hutcheson, Aaron A.

Columbia

Dodson, Kewen C.

Cookeville

Rundell, Richard W.

Covington

Moore, Willie M.
Wright, Ozell

Jackson

Farmer, Charles M.

Johnson City

Conerly, Steve G.

Knoxville

Allbaugh
Ames, Glenn C.W.
Atchison, J.A.
Bodenhop, Merton B.
Bauer, Larry Lee
Brasher, J.A.
Brown, David W.
Cashdollar, Parker D.
Cline, Donald L.
Culver, James A.
Cuskaden, Charles M.
Daniel, Raymond
Darter, Vernon W.
Davis, Joe T.
Dorminy, Hugh G. Jr.
Downen, M. Lloyd
Dubov, Irving
Eagan, Gerald V. Jr.
Elam, Thomas E.
Garland, Clark D.
Hancock, Curtis R. Jr.
Harris, Russell III
Hicks, B.G.
Hopkins, Robert J.
Humberd, David R.
Keller, Luther H.
Kerley, Charles R.
Lin, Ying-Nan
McManus, Benny R.
Martin, Joe A.
O'Neal, W. Glenn
Phillips, Dwight E.
Ranney, W.P.
Raskopf, Benjamin D.
Ray, Robert M.
Rector, Gerald R.
Sappington, Charles
Smith, George F.
Snell, James G.
Walch, Herbert N.
Weddel, Ronald D.
Whatley, Thomas J.
Williams, Donald L.

Louisville

Couvillion, W.C.

Martin

Murphey, C.S.

Memphis

Chisholm, Roger K.
Gregory, James C.
Harkness, Hosea S.
Hollowell, E. Graham
Smith, Charles S.
Townsend, George

Murfreesboro

Smith, Jimmy L.

Nashville

Brooks, Willie T. Jr.
Day, Vencial B.
Edwards, Richard J.
Goble, William E.
Griffith, Floyd W.
Ishikawa, Kiyoharu
Nicholls, William H.
Rao, Yallapragada
Rogers, Walter B.
Stockwell, Richard E.
Tang, Anthony M.
Telwar, Gul M.
Yallapragada, Bam

New Market

Mundy, Darrell

Powerl

Hinton, Troy W.

Somerville

Walker, Ollie R.
Winston, Joseph

TexasAmarillo

Garnett, Ed

Austin

Ferguson, David K.
Grubb, Herbert W.
McCauley, Robert S.
Palmer, Gary

Big Spring

Buxton, Stephen R.

Bryan

Black, William E.
Fairchild, Gary F.
Porterfield, Clyde Jr.
Riethmayer, Mike
Whitson, Robert E.

Bushland

Shipley, John L.

Canton

Furrh, Samuel R.

College Station

Barry, Peter J.
 Billingsley, Ray V.
 Blomo, Vito Jr.
 Boykin, Calvin Clay Jr.
 Branson, Robert E.
 Degner, Robert L.
 Dietrich, Raymond A.
 Doyle, Jack E.
 Edmonson, Vance W.
 Farris, Donald E.
 Freeman, Billy G.
 Grady, J.C.
 Harston, Clive R.
 Holmes, Mac R.
 Hopkin, John A.
 Hottel, James B.
 Jones, Lonnie Lee
 Lacewell, Ronald D.
 Lard, Curtis F.
 McGrann, James M.
 McNeely, John G.
 Mallett, James I.
 Martin, James R.
 Miller, James P.
 Miller, Jarvis E.
 Moore, Donald S.
 Morgan, James E.
 Murshed, Sayed M.
 Mustafa, Gholam
 Nichols, John P.
 Parker, Cecil A.
 Pearce, John C.
 Prater, Tom E.
 Schmedemann, Ivan W.
 Shaffer, Carl E.
 Simpson, James R.
 Sindt, Roger P.
 Sorensen, Harold B.
 Spurleader, Thomas L.
 Sprott, J. Michael
 Stelly, Randall
 Timm, Tyrus R.
 Trock, Warren Leigh
 Uvacek, Edward Jr.
 Wilson, Robert R.
 Wolf, Kenneth
 Wright, Arthur L.

Dallas

Anderson, Carl G.
 Brveck, David A.
 Dethlefsen, Russell
 Greene, Wallace R.
 McClelland, E.D.
 Reagan, Barbara B.
 Reagan, Sydney C.

Sharp, Ronald
 Stansbury, Dale L.
 Wilson, Charles M.

Danevang

Petersen, Ralph E.

Denton

Coffey, Frederic A.

Dickinson

Freeman, Roger L.

Fort Worth

Adkinson, Leslie B.
 Hubbard, O'Dean

Houston

Christian, W.E.
 Knop, Donald R.
 Rowe, T.Z.

Huntsville

Chandler, J.A.

Jacksboro

Williams, Ed

Littlefield

Nelson, James R.

Lockhart

Simkins, Arthur Ray

Lubbock

Bennett, J. Wayland
 Fergeson, Clint K.
 Flint, Wm. R.
 Foote, Richard J.
 Fowler, Mark L.
 Graves, James W.
 Kennedy, Rex P.
 Osborn, James E.
 Owens, Thomas R.
 Swann, Tommy J.
 Williams, Robert R. Jr.
 Williams, Willard F.

Omaha

Wright, J.R. Jr.

Palacios

Cunningham, Clarence H.

Richardson

Summitt, William R.

San Angelo

Daghestani, Eddie A.

San Antonio

Bain, Buford W.
 Erdmann, Herbert H.
 Gehling, Gerald J.
 Mehren, George L.
 Nordhauser, Fred

Stephenville

Lovell, Ashley C.

Vernon

Brints, Norman W.

Weslaco

Connolly, Chan

Wichita Falls

Granelle, Harry M.
 Krienke, Albert B.

UtahLogan

Aitken, Percy G.
 Andersen, Jay Clarence
 Anderson, Mark
 Anderson, Roice H.
 Christensen, Rondo A.
 Gardner, B. Delworth
 LeBaron, Allen D.
 McArthur, J. Wayne
 Stewart, Clyde E.
 Taylor, Morris H.
 Wennergren, Emil B.
 Whitaker, Morris
 Willis, Reed

Provo

Carbridge, Ivan L.
 Clark, Wayne W.
 Fuhrman, Walter U.
 Wood, Lowell D.

Salt Lake City

Baker, Forrest S.
Pincock, Mark G.
Sant, Paul T.
Wittman, Richard L.

Vermont

Burlington

Bevins, Malcom I.
Sinclair, Robert O.
Tompkins, Enoch H.
Tremblay, Raymond H.
Webster, Fred C.

Virginia

Alexandria

Bluestone, Herman
Coutu, Arthur J.
Fulton, Robert L.
Gale, Hazen F.
Heiby, Ernest D.
Henderson, Peter L.
Jones, Ronald W.
Kincannon, David L.
O'dell, Charles A.
Page, David A.
Randall, Kyle
Rogers, Robert O.
Stoddard, Everett O.
Walker, John H.
Wiecking, Ernest H.

Annandale

Daft, Lynn M.
Fulcher, Glen D.
Green, William A.
Samson, Glenn R.
Tannous, A. I.
Tontz, Robert L.

Arlington

Ahalt, Joshua D.
Andrews, B.G.
Baker, John A.
Bean, Louis H.
Brown, Richard N. Jr.
Butler, Gordon G.
Colyer, David W.
Davis, Joe Frank
Dunmore, John C.
Evans, James G.
Hamlin, Edmund T.
Haren, Claude C.
Hee, Olman
Inman, Buils T.
Jones, William W.
Kunkel, David E.
Lackey, Allan M.
Landstrom, Karl S.

Logan, William
Long, Mary E.
McMullin, L.D.
Matsumoto, Maso
Mimms, Otho L.
Moody, R.E.
Nicholson, Vessie H.
Nielsen, Aldon D.
Olson, Fred L.
Omar, Hanai A.
Publos, Ben H.
Santmyer, Carolee
Saville, R.J.
Schertz, Lyle P.
Schlechty, David L.
Scott, Raymond C.
Stierna, John H.
Taylor, Gary Charles
Timms, Dan
Treakle, Charles
True, Arthur W.
Umstott, Haven D.
Utter, Kenneth L.
Vermeer, James
Waugh, Frederick V.
Wheeland, Hoyt A.

Blacksburg

Bell, James B.
Boutwell, Wayne A.
Buck, John T.
Burkhart, G.W.
Cameron, Charles H.
Chambliss, Roger L. Jr.
Chiang, Ying-Chih
Coale, Charles W. Jr.
Conner, Maynard C.
Faris, Jesse E.
Gibson, William L. Jr.
Hand, William A.
Hardy, William E. Jr.
Harris, Harold M. Jr.
Holder, David L.
Jensen, Robert B.
Kenyon, David E.
Kline, Ralph G.
Little, Thomas W.
Long, Burl F.
Luckham, William R.
McMurtry, Gene
Marshall, James P.
Morris, Richard
Narrie, David B.
Oliver, James D.
Walrath, Arthur J.

Bridgewater

Haynes, Lawrence W.

Burke

Lough, Harold W.

Charlottesville

Huang, Yukon
Meiburg, Charles O.

Fairfax

Black, J.A.
Brown, Herbert
Demasters, Ellsworth D.
Reinsel, Robert D.
Ricardo, Jose M.
Seaborg, A.D.
Zimmer, John M.

Falls Church

Allen, Phillip T.
Atkinson, Jay
Barlow, Frank D. Jr.
Coffing, Arthur
Ellis, Frank E.
Gayoso, Antonio
Hansen, Peter L.
Hole, Erling
Honore, William H.
Jennings, George S.
Mahan, John N.
White, Bennett S.

Franklin

Rawls, Emmit L. Jr.

Great Falls

Tetro, Robert C.

Harrisonburg

Kipps, Paul H.
Mace, Almon T.
Mills, Neil B.

Lancaster

Moncure, Robert C.

Luray

Sibold, Don C.

Lynchburg

Tilmon, Hames D.

McLean

Bailey, Warren R.
Baker, John D.
Gasser, William R.
Halvarson, Lloyd C.
Herrmann, Louis F.

Pike, Clarence E.

Morgantown

Brain, Kathleen M.

Nokesville

Voelkel, Ray F.

Petersburg

Newlin, Kimrey D.

Richmond

Farmer, Berkwood M.
Moak, Samuel K.
Nuckols, Gray N. Jr.
Snider, Thomas E.

Springfield

Burke, Marguerite C.
Clampet, Gerald L.
Gallimore, William W.
Haas, John T.
Powell, L.A. Sr.
Thomasson, Larry F.

Strasburg

Johnson, Eherman E.

Vienna

Durose, Donald D.
Hoag, W. Gifford
Laubis, Robert E.
Swantz, Alexander

Washington

Connell

Adolph, Dale D.

Moses Lake

Conley, Dennis J.
Jones, Elwood C.

Pullman

Asante, Daniel C.
Bartlett, John L.
Barkley, Paul W.
Barron, James C.
Basit, Abdul
Bills, Nelson L.
Blakeslee, Leroy L.
Brewer, Thomas A.
Butcher, Walter R.

Casavant, Kenneth L.
Cordes, Sam M.

Corssmit, C.W.
Dailey, Richard T.
Davis, Bruce
Ditwiller, C.D.
Doran, Samuel M.
Duft, Kenneth D.
Florea, Burce A.
Folwell, Raymond J.
Fuglestad, Paul
Gray, William H. III
Greig, W. Smith
Hammond, Jerome J.
Harrington, Albert H.
Hobson, Karl
Infanger, Craig L.
Kluver, Dennis E.
Lee, Paul Shen Tun
Loomis, Ralph A.
Mackey, R. Bruce
Nielson, James
Oehschlaeger, R.E.
Oldenstadt, Dennis L.
O'Rourke, Andrew D.
Peterson, Arthur W.
Pietsch, William H.
Price, David W.
Rehberg, Wallace A.
Rodewald, G.E. Jr.
Rogers, Leroy F.
Schroffell, S.A.
Thomson, James W.
Umberger, Dwight E.
Waananen, Martin V.
Welch, George Baker Jr.
West, Donald A.
Whittlesey, Norman K.
Wirak, Owen S.
Wirth, Myron E.
Womach, Jasper A.

Puyallup

Searls, E.N.

Richland

Cone, Bruce W.

Seattle

Bare, B. Bruce
Bufton, Ere E.
Richards, Jack A.
Wilcox, Emery C.
Youngstrom, Ann L.

Spanaway

Walter, Alan S.

Spokane

Cairns, Luman E.
Joss, Alexander
Walker, Donald L.

Tacoma

Miller, Marlen F.

Waitsburg

Lawrence, Ed

Walla Walla

Neumeier, Clarence E.

Wenatchee

Seeman, Raymond G.

Yakima

Hovey, Roy M.

West Virginia

Bucknannon

Nair, K.R.

Glenville

Bucke, Ronnie L.

Morgantown

Barr, Alfred L.
Brock, Samuel M.
Clarke, James H.
Colyer, Dale K.
Dufresne, A.N.
Evans, Homer C.
Ferrise, Anthony
Hock, Kenneth J.
Kuehn, John P.
McIntosh, Kenneth D.
Nesselroad, Paul E.
Templeton, Mary C.
Toben, George E.
Yost, Larry E.

Princeton

Dempsey, Gilbert P.

Shepherdstown

Stine, Oscar C.

WisconsinBlue Mounds

Hobson, Asher

Chippewa Falls

Namejunas, Alfred

Eau Claire

Gochberg, Howard S.

Fond du Lac

Miller, Arthur

Fort Atkinson

Knox, W.D.

Green BayHaney, Emil B. Jr.
Kolshus, Halvor J.
Shariff, IsmailLa Crosse

Daelenbach, L.A.

MadisonAbbad, Karrar A.
Bale, M.D.
Barriga, Claudio
Barrows, Richard Lee
Bawden, D. Lee
Beebout, Harold S.
Brodie, John D.
Bromley, Daniel W.
Busse, Ruehen C.
Chen, David Yi
Christiansin, Rudolph A.
Clodius, Robert L.
Cook, Hugh L.
Cook, Michael L.
Cooper, Rollin B.
Cutie-Tula, Jesus
Dadd, Christopher M.
Dahl, Wilmer A.
Dobson, William D.
Dorner, Peter D.
Ebling, Walter H.
Erikson, Arval L.
Fabiyyi, Yakub L.
Freeland, Marks
Graf, Truman F.
Groves, Francis W.
Guebert, Steven R.
Hamm, Larry G.
Harkin, Duncan A.Helmberger, Peter G.
Kanel, DonLai, Lily Kuo
Larson, Adlowe
Lord, William B.
Lowe, James C.
McCabe, Bernard O.
Mayer, Ralph E.
Meyer, Neil L.
Mhueller, Willard F.
Moyer, D. David
Naeem, Shaikat A.
Ogunranbi, Olandejo
Parsons, Kenneth H.
Penn, Walter J.
Peterson, Gustof A.
Peterson, Hans P.
Pulver, Glen C.
Reed, Robert H.
Rieck, Robert E.
Robinson, R. Wayne
Rosner, Monroe H.
Roumasset, James A.
Schamper, John W.
Schmidt, John R.
Shoenemann, John A.
Smith, Stephen C.
Smith, Stephen M.
Sparling, Edward W.
Strasma, John
Thiesfinhusen, William C.
Toguel, Marcelo M.
Verma, S.K.
Weber, Bruce A.
Weidemann, W. C.
Weigle, Richard N.
Willett, Gayle S.Bay Shore

Berry, James E.

Middleton

Vilstrup, Richard

New Richmond

Wiseman, Wayne C.

Oregon

Cohee, M.H.

Oshkosn

Mitchell, Milton G.

PlattevilleCottingham, John E.
Cropp, Robert A.
Key, Jeff

Peterson, Jan E.

River FallsElefson, R. Vern
Kao, Charles H.
Nolte, Gerald M.
Rhode, Gary E.Superior

Behr, Michael R.

WyomingCasper

Johnson, Glen Jr.

LaramieBlood, Dwight M.
Clark, Richard T.
Dobbs, Thomas L.
Ehrich, Rollo L.
Fletcher, Robert R.
Hawkinson, Arthur E. Jr.
Kearl, Willis G.
Olson, Carl E.
Phillips, Clynn
Roehrrasse, Glenn P.
Schlagel, Melvin
Schutz, Willard D.
St. Clair, James S.
Stevens, Delwin M.
Usman, Mohammad
Vanvig, Andrew
Wedemeyer, William G.
Williams, Robert G.Rozet

Hamm, Don R.

CANADAAlbertaCalgaryFriesen, Bruno
Madill, John W.EdmontonAllen, Elmer C.
Apedaile, Leonard P.
Bayda, William M.
Clarke, James W.
Ferries, Clarke H.

Hawkins, Murray H.
Hurnanen, Roy R.
Lamble, Wayne
Long, Roger B.
Love, Harold C.
Macmillan, James A.
Manning, Travis W.
Norby, Reginald R.
Olson, Daryl R.
Petersen, Thomas A.
Phillips, William E.
Porter, Kenneth D.
Quantz, Lloyd
Racham, Thomas S.
Richter, Joseph J.
Schultz, Wolfgang M.
Stickland, Kenneth W.
Veeman, Michele
Walker, David
Warrack, Allan A.

Lethbridge

Sonntag, Bernard H.

St. Albert

Hackett, Bruce A.
Stanley, Paul D.

Vermillion

Nelson, Clarence A.

British Columbia

Burnaby

Khan, Mahood A.

Nan Almo

Reimer, Don R.

Vancouver

Arcus, Peter L.
Dorling, Michael J.
Elgard, Knud
Pervis, Dennis W.
Wills, Ian Robert
Winram, James M.
Winter, George R.

Victoria

Turner, Alexander H.

Manitoba

Arborg

Mitchell, Robert F.

Brandon

Gills, Robert J.

St. Boniface

Terrien, Gerard A.

St. Norbert

Lee, Bruce M.

Winnipeg

Andah, Emanuel
Anim-Appiah, John
Baxter, E.E.
Beaton, Norman J.
Bolman, Ray D.
Chen, Ley-Cheng
Clark, John
Cormack, John M.
Craddock, William J.
Dolly, John R.
El-Naaha, Y.T.
Fisher, Gary R.
Framingham, Charles F.
Gillman, Arthur S.
Gilson, James C.
Hamilton, Frederick W.
Hudson, Jack P.
Iga, Masaaki
Jacobs, Peter C.
Lane, Grove A.
Lee, Craig E.
Lockhart, William J.
Longmuir, Nelson L.
Loynes, Richard M.
Lu, Wen-Fong
Mc Bride, William A.
Matheson, G. Alan
Menzies, Merrill W.
Naik, H.K.
Nelson, Gary S.
Oyeneye, Sunday A.
Pandey, Rama K.
Paquin, Fernond L.
Pingsun, Shih
Poore, Edwin R.
Rigaux, Lawrence R.
Ross, Carlyle B.
Rudder, Winston R.
Sinclair, Sol
Singh, Ranjit H.
Sun, Shih-Ping
Tangri, Om P.
Teskey, Alan G.
Tyrchniewicz, Edward W.
Wilson, Arthur G.
Wood, Arthur W.
Yeh, Martin H.

New Brunswick

Richibucto

Piracha, Zafar

Newfoundland

St. Johns

Parh, Murray N.

Nova Scotia

Truro

Byers, Douglas M.
Grant, Walter V.
Gunn, T. Campbell

Ontario

Almonte

Cotterill, Ralph E.

Guelph

Batterham, Robert
Bradshaw, Garfield J.
Braithwaite, W.M.
Britney, John B.
Clark, J.H.
Driver, H.C.
Flinn, John C.
Funk, Thomas F.
Gray, Edward C.
Guiman, Joseph F.
Hayhurst, France T.
Huff, Harry B.
Jenson, Earl A.
Keeler, Karl F.
Lane, Stewart H.
Lawrence, John A.
Lockwood, Robert C.
Marshall, Robert G.
Mohammed, Gmiasudeen
Pallangyo, Ephaton P.
Perkins, Brian B.
Phillips, Truman P.
Singh, Harmit
Warley, Thorald K.
Wright, Philip A.
Zellner, Rober E.

Hamilton

Mackenzie, William

Islington

Leckie, H. Keith

Kemptville

Cochran, James R.

London

Haessel, Walter

OshawaBennett, H. Grant
Moon, RobertOttawaAndal, Melvin E.
Anderson, Robert W.
Appleton, Peter L.
Beckford, M.L.
Birbeck, W.H.
Booth, John F.
Carr, Howard D.
Dawson, John A.
Dyck, Diedrich
Finn, Gerald T.
Furniss, I.F.
Gilchrist, Varge
Harrison, A.H.
Haythorne, George V.
Hiscocks, Geoffrey A.
Hopper, William D.
Hudson, S. Claude
Jaska, Elmar
Kirk, David L.
Lerohl, Milburn L.
Lubin, J.D.
McGlaughlin, Glen R.
McEachern, Gordon A.
Nacker, Roger M.
Owen, George
Plaunt, Darrel H.
Porteous, W.L.
Porter, Winston D.
Richards, Douglas R.
Rust, Ronald S.
Sahi, Ram Kumar
Sahota, Joginder S.
Shefrin, Frank
Spoerri, Arthur E.
Stutt, Ralph A.
West, Donald A.
Yang, William Y.Ridgetown

Wagner, Richard C.

Scarboro

Campbell, Blair

Thunder Bay

Harris, Thomas D.

TorontoArnold, George W.
Cloutier, Raymond M.
Fan, Charles C.
Haslett, Earl A.
Hurd, Lorne W.
Hutchinson, John D.
Jaeger, Martin J.
Loh, Michael
McDonald, Geoffrey T.
Macdonald, Archie B.
Redelmeier, W. R.
Rusk, James A.
Weijs, John H.Windsor

Callaghan, John F.

Prince Edward IslandCharlottetownLovering, James
Nagarjan, P.Montague

Bowman, Austin L.

QuebecMaurice

Perrault, Roger

MontrealHarsany, Peter
Lavigne, Benoit J.Quebec ProvinceBlanchard, Henri-Paul
Dubuc, Roger
St. Louis, RobertSte-Foy

Wampach, Jean-Pierrem

SaskatchewanN. Battleford

Duncan, Howard J.

ReginaBurwell, Thomas J.
Eyvindson, Roger K.
Fast, Henry R.
Heidt, Anthony A.Petrie, T.M.
Riecken, Theodore O.SaskatoonBrown, Jacob A.
Clift, Patrick J.
Craddock, Charles T.
Cuthbert, Ron
Elmgren, Lyle
Fisher, Robert G.
Kroll, Arnold V.
Kulshreshtha, S.N.
Lee, George E.
Morris, James B.
Nicholson, Raymond C.
Storey, Gary G.
Thair, Phillip J.AFRICACamerounYaoundeFerguson, Donald F.
Whittaker, Victor A.ColombiaCali

Anderson, Pinstруп

CongoKinshasa

Tollens, Eric F.

EgyptCairoCortas, A.N.
Gad, Mahmoud M.
Shabana, Zaki M.EthiopiaAddis AbabaAsfaw, Tsegaye
Asmelash, Tsegaye
Belaineh, Girma
Goering, Theodore J.
Haregwein, Mamaru
Muleta, Yoseph
Woldegiorgis, Getahoun
Worku, Debebe
Zerihoun, Tamrat

Dire Dawa

Bekure, Solomon
Birke, Lakew
Tekelmariam, Yilma

GhanaAccra

Amofo, Jones G.
Anderson, W.J.
Dako, Fred Obeng
Gakogo, Godwin W.K.
Nahyi, Assibi
Selley, Roger A.

Bolgatanga

Turkson, Joseph T.

Cape Coast

Ofosu-Amaning E.

Hovr

Nfodjo, S.K.

Kumasi

Donkor, Francis B.
Erbynn, Wm. K.G.

Tamale

Dwumfuoh, Paul

Ivory CoastAbidjan

Weiss, Joseph S.

KenyaNairobi

Etherington, Dan M.

LiberiaMonrovia

Browne, Henry C.

MalawiBlantyre

Dzingomuera, Datson M.

Karonga

Jere, Young J.S.

Kasunga

Kaimila, Falyson W.

Zomba

Golosi, Lloyd F.

NigeriaEnuga

Onuaha, John N.

Ibadan

Hedley, Douglas D.
Olayide, Samson
Otitoju, Ezekiel O.

Ile-Ife

King, David T.

Kaduna

Baba, Umaru Muhammad

Kano

Rufai, Ahmadul

Lagos

Popoola, W.O.

Zaria

Simmons, Emmy B.

Sierra LeoneFreetown

Deen, Sanusi S.
Spencer, Dunstan S.V.

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TanzaniaMorogoro

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Dar Es Salaam

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TunisiaKsour

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La Marsa

Meddeh, Ahdelaziz

Tunis

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UgandaArua

Manano, John B.S.
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Soroti

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ZambiaFort Jameson

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ASIAAfghanistanKabul

Mobin, Abdul

Hava

Stanickazi, F.

CeylonColombo

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BangaloreMurthy, A.N.K.
Taylor, Donald C.Bihar

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Rao, Venkata
Seshan, Ananthanara Y.Cuddapah

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Nagar

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Patnik, P.K.

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Nahavand

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Shiraz

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IraqMosul

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Misawa, Takeo
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Arabiat, Sulaiman M.
Wahby, OmarKoreaNam-Do

Kim, Sung Hoon

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Chung, Hoon Bo
Chung, Yil Seun
Jong, Pock Cho
Kim, Dong H.
Kim, Jeong Bae
Kim, Jong, Moo
Kim, Kwang Hee
Kim, Sang-Gee
Kim, Tongbin
Lee, Dong-Bai
Ryu, Byung Seo
Suh, Jai M.
Whang, Ki HyunLebanonBeirutAkl, Maroun
Brough, Owen L.
Greene, Brooke A.
Nightingale, Ray W.
Odeurs, A.
Stickley, S. ThomasMalaysiaKedah

Mohamed, Khairi H.

NepalJanakpur

Joshi, Shiva Ram

Kathmander

Giri, Jaya Ram
Pant, Thakur N.
Shrestha, Shankar M.

Rupandehi

Tripathi, Saraswati K.

Pakistan

Dacca

Huq, Aik F.

Islamabad

Mia, Mossaref H.
Qamar, I. Jaz A.

Lahore

Eckert, Jerry B.
Qadir, Chaudry G.

Lyallpur

Aslam, Muhammad
Chaudhary, A.M.

Mymensingh

Farruh, Osman
Hague, M.D.F.
Hasan, Muhammed Ali
Molla, Mohammad R.I.

Pabna

Islam, A.K.M.

Philippines

Cabanatua

Payumo, Franklin A.

Caloocan City

Barrando, Nelson A.

Laguna

Borton, Raymond E.
Librero, Aida Recto
Mataverde, Avrelia M.

Makiti

Barker, Randolph
Korzan, Gerald E.

Manila

Bacos, Romeo S.
Duff, Jack B.
Gapud, Jose P.
Liao, Shubert S.C.
Peredo, Benjamin D.

Pasay City

Idos, Ernesto E.

Quezon City

Calayag, Benjamin S.
Divinaaracia, Jessie
Mangahas, Mahar K.
Rojas, Jesus L.
Vibar, Manuel R.

Saudia Arabia

Ridiyadh

El-Soadi, Mohamed A.

Thailand

Bangkok

Boer, John De
Boonma, Chamnien
Bursongsikul, Olsakdi
Grimble, R.
Hanpongpanth, Somporn
Ong, Shaoer
Partaya, Pongphan
Pongphan, Partaya
Pongspon, Surapant
Sukonthasit, Varasit
Supote, Dehates
Suwan, Traipol
Tasukonth, Bancha
Welsch, Delane E.
Yamashita, M.

Khon Kaen

Siriruga, Chumnarn

Nonthaburi

Lakawathana, Suwaphot

Vietnam

Saigon

Kham, Pham Thanh
Sang, Ho Quang
Toam, Vu

AUSTRALIA

Australian Capital Territory

Canberra

Crawford, John G.
Cuthbertson, Andrew G.
Penny, David H.

New South Wales

Armidale

Anderson, John R.
Dillon, John L.
Guise, John W.
Hardaker, John B.
Johnston, James H.
Mackay, David R.
Musgrave, Warren F.
Powell, Roy A.

Kensington

Filan, Stephen J.

Sydney

Campbell, Keith O.
Gillin, Edward F.
Maccallum, David E.

Queensland

Rao, Vadlamudi Y.
Sohn, Hong Keun

South Australia

Adelaide

Brown, William A.N.
Casey, Thomas M.
Jarrett, Frank G.
Lindner, Robert K.

Unley

Anderson, Kym

Victoria

Kew

Ryan, Timothy J.

Melbourne

Ward, Lionel E.
Williams, Donald B.

Parkville

Sturgess, Neil H.

Toorak

McMillan, Robert B.

CANAL ZONEPanamaBalboa

Hoffman, Randall A.

CENTRAL AMERICACosta RicaSan Jose

Munoz, Miguel A.

Dominican RepublicSantiago

Martinez, Rafael B.
Olivares, Felix
Volmar, Gustavo S.

Santo Domingo

Aquino, Carlos E.
Batista, Jorge C.
Fanas, Juan I.
Nolasco, Joaquin
Nunez, Juan A.

El SalvadorSan Salvador

Pena, Edvardo

HondurasComayaguella

Soto, Leonel R.

MEXICOMexico City

Delgado, Enrique C.
Flores, Edmundo
Martinez, Lic G.
Venezian, Edward L.

SonoraHermosillo

Gutierrez, Jose S.

West IndiesGrenada

McMillan, Wendell M.

Haiti

Julien, Jean Nicot

EUROPEAustriaVienna

Abram, Reinhart

BelgiumBrussels

Sener, Ismail

DenmarkCopenhagen

Mortensen, Erik H.

FranceDijon

Petit, Michael J.

Nevilly

Barast, Gabriel G.

Paris

Baker, Francis R.
Bergmann, Denis R.
Bergman, Raymond

Vandeputte, Joseph M.

Poitiers

Cotier, J.P.

Vanves

Defarcy, Henri M.

GermanyBonn

Pfahler, Fritz

Göttingen

Heidhues, Theodor H.

Hohenheim

Weindlmaier, Hannes

Kiel

Weber, Adolf

Kreuznach

Hesselbach, Josef

Volkenrode

Bucholz, Hans Eberhard

GreeceAthens

Athanassatos, George
Bernaris, A.
Critharas, C.P.
Dermentzopoulos, Apostolos
Liakatas, Luke J.
Michalopoulos, George J.

Thessaloniki

Koutsoudakis, Vassilios A.
Trimis, Antefies E.
Vezyroglou, Ioannis

ItalyNaples

Gaetani d' Aragona, Gabriele
Nagliane, Dott R.
Pacifico, Carlo P.
Pasca di Magliano, R.

Piacenza

Galizzi, Giovanni
Rizzi, Pierluige
Secondo, Tarfiti Dr.
Tarditi, Secondo P.

Portici

Benedictis, Michele de
DeAnzelis, Lucio
DeBenedictis, Michele

Rome

Abbott, John C.
Agrawal, Babu Lal
Bachman, Kenneth L.
Baldini, Bruno
Damnjanoyie, Ziuko
Mittendorf, Hans
Shaw, David J.
Taylor, Stuart M.
Wells, Oris V.

NetherlandsHaren

Rooij, Jan Van

The Hague

Athmer, Jan H.

Tilburg

Kirellaars, Franciscus

NorwayLoftnus

Haugse, Lars

Vollebekk

Glaever, Harald B.

PortugalLisbon

Espada, Joao Mendes

SpainCastellon

Bofias, Pedro Padros

Cordoba

Blanco, Manuel M.

Madrid

Alvarez, Vicente Boceta
Boceta, Vincente
Briz, Julian E.
Checchi, Alessandro L.
Egido, Garrido
Keller, Rodrigo
Leovigildo, Garrido E.
Padros, Bofias

Zaragoza

Tellez, Jayier

SwedenLund

Gustafsson, Bengt

Uppsala

Birowo, Achmad T.
Isaksson, Nils-Ivan
Olsson, Rolf

Vara

Brink, Lars

SwitzerlandBern

Popp, Hans W.

Fonnex

Borlin, Max

Fribourg

Pasquier, Jacques

Vaud

Dabasi-Schweng Lorand

TurkeyAnkara

Berk, Metin
Burunah, Hirmet
Eryurek, Mete
Ozkan, Hudai

Erzurum

Aksoz, Ibrahim
Toraman, Ayhan
Zoral, Kutly J.

Istanbul

Aganoglu, Ali

PACIFIC ISLANDSFijiSuva

McGregor, Andrew
Story, David

IndonesiaDjakarta

Aritonang, Mongara S.
Babbar, Madan Mohar
Dalam, Hatta Warga
Hutabarat, Panturi
Kusumadewa, Arle L.

New ZelandCanterbury

McCarthy, W.O.

Palmerston North

Cartwright, R.W.
Rae, Allan Neville
Townesley, Robert J.

SOUTH AMERICAArgentinaBuenos Aires

Blanco, Jorge O.
Fienup, Darrell F.
Fiorentino, Raul
Frigerio, Norberto
Gamba, Julio R.
Maffucci, Eugenio A.
Ravizzini, Elisabeth D.
Socas, Salvador C.
Viticcio, Guillermo L.

Capital Federal

Pineiro, Martin E.

<u>Mendoza</u>	<u>Santa Maria</u>	<u>Guyana</u>
<u>Chacras de Coria</u>	Peretti, Heitor O.	<u>Georgetown</u>
Bertranou, Armando	<u>Sao Paulo</u>	Phillips, Winston J.
<u>Cruz</u>	Aravjo, Paulo Fernando	<u>Peru</u>
Zapata, Juan Antonia	Arroyo, Clovis J.	<u>Lima</u>
<u>Gutierrez</u>	Assumpcao, Svaldo	Huambachano, Jaime
Biondolillo, Aldo Luis	Engler, Joaquim	Luma, Carlos
<u>Sante Fe</u>	Filho, Waldemar	Reyes, Pedro F.
<u>Rafaela</u>	Lunardelli, Antonio	Robertson, Thyrele
Rouco-Oliva, Jose O.	<u>South Catarina</u>	Sarria, Carlos
<u>Brazil</u>	Hoeltgebaum, Francisco	Torres, Hugo A.
<u>Brasilia</u>	<u>Chile</u>	<u>Venezuela</u>
Filho, Francisco V.	<u>Santiago</u>	<u>Caracas</u>
Pedroso, Iby A.	Bellarmino, Centro	Baez, Mauricio
Silva, Amairton D.M.	Francisco, E.	Garcia, Jose B.
Sooza, Wagner	Roca, Gaston K.	Greenman, Almon C.
<u>Parana</u>	Troncoso, Jose L.	Jefferies, Gene L.
Tschoeke, Werner	Valdes, Alberto	Orta, Celio S.
<u>Goiania Goias</u>	<u>Colombia</u>	Stredel, Juan B.
<u>Guanabara</u>	<u>Bogota</u>	<u>Merida</u>
Pereira, Aiz do Canto	Brunort, Pier G.	Peinado, Marcelo A.
<u>Minas Gerais</u>	Carrasco, Alfredo	<u>St. Joseph</u>
Alves, Elifjev R.	Chacon, Edvardo	Kovacs, Alejandros
Magalhaes, Luiz J.A.	Gregory, Wade F.	
Saturino, Mario A.	Huertas-Escallon, A.	
Souza, Antonio F.	Jimenez, Guillerma	
Vieira, Guaracy	Montes, Lazaro	
Villas, Andres T.	Vidal, Manuel H.	<u>UNITED KINGDOM</u>
<u>Pernambuco</u>	<u>Calif</u>	<u>England</u>
Azevedo, Adierison	Maiguashca, Franklin	<u>Kent</u>
Conolly, Ladjane	Pinstrup-Anderson, P.	Britton, Denis K.
<u>Rio Grande do Sul</u>	Posada, Alvaro	Carruthers, Ian D.
Andrade, Jose G.	<u>Cordoba</u>	Gwyer, George D.
Souza, Eli de M.	Garcia, Edvardo A.C.	<u>London</u>
<u>Rio de Janerio</u>	<u>Manizales</u>	Josling, Timothy E.
Rocha, Jober	Londono, Diego	Lewis, Jack N.
Vianna, Raulo R.	<u>Medellin</u>	Slater, John M.
	Lopera, Jorge	<u>Manchester</u>
	<u>Ecuador</u>	Colman, David R.
	<u>Quito</u>	McInerney, John P.
	Schwartz, Michael	Rayner, Anthony J.
		Smith, Sheila M.

Newcastle Upon Tyne

Davey, Brian H.
Hazell, Peter B.
Reekie, C. Ian M.
Whitby, Martin C.

Norfolk

Gossling, William F.

Nottingham

Ingersent, Kenneth A.

Reading

Butterworth, Keith

Sussex

Biggs, Stephen D.
Joy, J. Leonard

IrelandGalway

Higgins, Patrick J.
Scully, John J.

ScotlandFife

Jackson, Anthony A.

Edinburgh

Lilwall, Nicholas B.

Glasgow

Houston, George
Middleton, David R.

WalesPenglais

Green, David A.G.

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Station

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Central District

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of Engineers

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Pacific

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Colorado

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Denver Federal Center

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Economics Staff
Denver Federal Center

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Denver Public Library

Durango

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College

Fort Collins

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University

Rocky Mt. Forest & Range
Experiment Sta. Library

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Library, Colorado State
College

USAF

Academy Library (DFS LB)
U.S. Air Force Academy

ConnecticutGreenwich

Corporate Bus. Library
American Can Co.

Hartford

John C. Lincoln Inst.

Middletown

Olin Library, Wesleyan
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Economic Growth Center
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Univ. of Hawaii Libr. Hilo Campus	National Assn. of Real Estate Boards, Libr.	<u>Normal</u>
<u>Honolulu</u>	Roosevelt Univ., Libr.	Illinois State Univ., Milner Library
Univ. of Hawaii, Libr.	University of Chicago Library	<u>Springfield</u>
<u>Idaho</u>	U.S. Dept. of Agr. Commodity Exch. Auth.	Illinois State Library
<u>Moscow</u>	Univ. of Illinois at Chicago, Library	Sangamon State Univ., Libr.
Univ. of Idaho, Libr.	<u>Crystal Lake</u>	<u>Urbana</u>
<u>Pocatello</u>	McHenry County College	University of Illinois Library
Idaho State University, Library	<u>De Kalb</u>	<u>Indiana</u>
<u>Texburg</u>	Steven F. Parson Libr., Northern Illinois Univ.	<u>Bloomington</u>
Ricks College, David O' McKay Library	<u>East Peoria</u>	Indiana University Libr.
<u>Twin Falls</u>	Library, Illinois Central College	<u>Evansville</u>
College of Southern Idaho, Library	<u>Edwardsville</u>	LSU - Evansville Campus Library
<u>Illinois</u>	Southern Illinois Univ. Lovejoy Mem. Libr.	<u>Fort Wayne</u>
<u>Carbondale</u>	<u>Evanston</u>	Indiana Purdue Reg. Campus, Library
Southern Illinois Univ. Library	Northwestern Univ. Libr.	<u>Gary</u>
<u>Centralia</u>		Northwest Campus of Indiana Univ., Libr.
Kaskaskia College, Libr.		

Yale Forestry Library
Yale University

New London

Library, Connecticut
College

Stamford

Library, ICI America Inc.

Storrs

University of Ct.

Wilbur L. Cross Libr.
University of Ct.

West Hartford

Mortensen Library
Univ. of Hartford

Delaware

Dover

William C. Janson Libr.
Delaware State College

Newark

University of Delaware
Morris Library

District of Columbia

Washington

Am. Agr. Econ. Documen-
tation Center, Natl.
Agr. Library

American Univ. Library

Board of Governors of the
Fed. Res. System, Libr.

Catholic Univ. of America,
Mullen Library

Columbus Mem. Library
Pan American Union

Dept. of State Library

Environmental Protection
Agency Library, Federal
Trade Commission

George Washington Univ.,
The University Library

Joint Bank Fund Libr.

Legislative Reference
Service, Library of
Congress

Library, The Brookings
Institution

Library, Inter-American
Devl. Bank

Library, Resources for
the Future Inc.

Office of Econ. Oppor-
tunity, Library

Office of Mgmt. & Budget

Robert R. Nathan
Associates, Inc.

Treasury Library

U.S. Army of Topographic
Command, Corps of Eng.

USDA - ASCS Info. Center

USDA - Commodity Exch.
Authority

USDA - ERS

USDA - MED

USDA - National Agr.
Library

USDA - Office of Plng.
and Evaluation

USDA - Soil Conservation
Service

USDA - Stat. Reporting
Service, Standards &
Records Div.

USDC - Library

U.S. Dept of the Int.
Office of Library Ser.

U.S. Dept. of the Int.
Bur. of Land Mgmt.

U.S. Dept. of Labor,
Library

U.S. Tariff Comm.,
Library

Florida

Boca Raton

Florida Atlantic
University

Coral Gables

University of Miami
Library, University
Branch

Deland

Dupont Ball Library,
Stetson University

Gainesville

Florida Farm Bur. Fed.

Hume Library, Agr. Expt.
Sta. Univ. of Florida

Pensacola

Library, Univ. of West
Florida

Tallahassee

Florida A & M University

Florida State Univ. Libr.

Tampa

Library, Univ. of South
Florida

Tampa Public Library

Georgia

Americus

Library, Georgia South-
western College

Athens

Library, Univ. of Ga.

Atlanta

Fed. Res. Bank of
Atlanta, Library

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Library

Greencastle

Roy O. West Library
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Independence

Lake County Public
Library

Indianapolis

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Business Library

Indiana University,
Indianapolis Law School
Library

Indiana State Library

Lafayette

Purdue Research Found.,
Purdue University

Serials Unit, Purdue
University Libraries

Muncie

Library, Ball State
University

Notre Dame

Memorial Library,
University of Notre Dame

Terre Haute

Indiana State Univ.,
Cunningham Mem. Libr.

IowaAmes

Iowa State Univ. of
Sci. Tech. Library

Des Moines

State Traveling Library

Dubuque

Wahlert Mem. Library,
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Grinnell

Grinnell College, Libr.

Iowa City

Law Library, Univ. of
Iowa

Univ. of Iowa, Libr.
Lamon

Graceland College

Oskaloosa

Wilcox Library,
William Penn College

KansasEmporia

William A. White Libr.
Kansas State Teachers
College

Garden City

Garden City Community
Junior College, Libr.

Hays

Forsyth Library, Fort
Hays

Kansas City

Kansas City Public
Library

Lawrence

Library, Univ. of
Kansas

Manhattan

Dept. of Econ. Kansas
State Univ.

Library, Kansas State
University

Ottawa

Myers Library, Ottawa
University

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Bank of Wichita Libr.
Wichita State Univ.

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Bowling Green

Western Kentucky Univ.
Science Library

Covington

Northern Ky. State
College Library

Frankfort

Libraries
State of Kentucky

Lexington

Agr. Library, Univ.
of Kentucky

Dept. of Agr. Econ.
University of Kentucky

Library, Univ. of Ken-
tucky

Morehead

Johnson Camden Libr.,
Morehead State College

Murray

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University

Richmond

Eastern Kentucky Univ.,
Crabbe Library

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Louisiana State Univ.
Library

Grambling

A.C. Lewis Mem. Library
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Hammond

Sims Mem. Library,
Southeastern La.
College

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University Libraries Univ. of Southwestern La.	<u>Beltsville</u>	Library, Suffolk Univ.
<u>Monroe</u>	National Agr. Libr.	Library, United Fruit Company
Sande Library Northeast La. Univ.	<u>Chestertown</u>	Univ. of Ma., Library- Boston
<u>New Orleans</u>	Clifton M. Miller Libr.	
Loyola Univ. Library	<u>College Park</u>	<u>Cambridge</u>
Southern Forest Experi- ment Sta., Library	Bur. of Business & Econ. Res., Univ. of Md.	Harvard Univ., Littauer Library
Southern Univ. in New Orleans, Library	Bur. of Commercial Fisheries	Hiles Library, Radcliffe College
Tulane Univ. Library	Univ. of Md., Library	Library, Harvard Econ. Res. Proj., Harvard Univ.
<u>Ruston</u>	Univ. of Maryland Undergraduate Libr.	Ma. Inst. of Technology MIT Libraries
La. Poly. Inst. Prescott Memorial Library	<u>Hyattsville</u>	
<u>Thibodaux</u>	Agri-Business Programs ARS-USDA	<u>Chestnut</u>
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<u>Maine</u>	Frederick Douglas Libr. Univ. of Maryland	<u>Medford</u>
<u>Brunswick</u>	<u>Salisbury</u>	Library, Tufts Univ.
Bowdoin College Library	Blackwell Library Salisbury State College	<u>North Dartmouth</u>
<u>Gorham</u>	<u>Silver Spring</u>	Library, Southeastern Ma. Tech. Inst.
Library UMPG	Technical Processes Sect. Ad	<u>Waltham</u>
<u>Orono</u>	<u>Massachusetts</u>	Brandeis Univ. Library
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<u>Portland</u>	Amherst College Libr.	Library, Wellesley College
Univ. of Maine in Portland, Library	Library, Univ. of Ma.	<u>Williamstown</u>
<u>Maryland</u>	<u>Babson</u>	Williams College Libr.
<u>Baltimore</u>	Babson Inst. Library	<u>Worcester</u>
Enoch Pratt Free Library	<u>Boston</u>	Assumption College Libr.
Johns Hopkins Univ. Libr.	Boston Univ. Libraries	Clark University
Loyola College Library	Harvard Business School Baker Library	<u>Michigan</u>
Morgan State College Libr.		

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	<u>Minnesota</u>	<u>Hattiesburg</u>
	<u>Canby</u>	Libr., Univ. of Southern Mississippi
<u>Benton</u>	Canby Area Voc. Tech. Inst.	<u>Jackson</u>
Whirlpool Corp, Info. Center	<u>Duluth</u>	Library, Jackson State College
<u>Dearborn</u>	Univ. of Mn., Duluth Br. Library	<u>Larman</u>
Univ. of Mi., Dearborn Campus Libr.	<u>Mankato</u>	Library, Alcorn A&M College, Ms. Libr. Commission
<u>Detroit</u>	Memorial Library, Mankato State College	<u>State College</u>
Detroit Public Library	<u>Marshall</u>	Mitchell Meem Library Ms. State University
Univ. of Detroit Libr.	Southwest Mn. State College, Library	<u>Stoneville</u>
Wayne State University Library	<u>Minneapolis</u>	Library, Delta Br. Expt. Station
<u>East Lansing</u>	Cargill Research Libr. Cargill Inc.	<u>University</u>
Library, Mi. State Univ.	Economic Research Libr. Univ. of Mn.	The Library, Univ. of Ms.
Mi. State Univ., Dept. of Agr. Econ.	James Jerome Hill Ref. Libr.	<u>Missouri</u>
Mi. State Univ., Sociology Expt. Sta.	<u>Cape Girardeau</u>	
<u>Haughton</u>	Library, Federal Reserve Bank of Minneapolis	Kent Library, Southeast Missouri State College
Library, Mi. Tech. Univ.	Minneapolis Public Libr	<u>Columbia</u>
<u>Kalamazoo</u>	The University of Mn.	Univ. of Missouri, Libr.
Waldo Library, Western Mi. University	Univ. of Mn., Libraries	<u>Kansas City</u>
<u>Livonia</u>	Waite Memorial Library, Univ. of Mn.	Kansas City Public Library
Schoolcraft College, Libr.	<u>Northfield</u>	Linda Hall Library
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<u>Maryville</u>	The Alumni Library Creighton University	<u>Union</u>
Wells Library, Northwest Mo. State College	<u>Nevada</u>	Louise Morrow Library Best Foods Res. Center
<u>Rolla</u>	<u>Las Vegas</u>	<u>New Mexico</u>
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Univ. of Mo. - St. Louis Library	<u>New Hampshire</u>	Library, Eastern N.M. Univ.
Washington Univ. Libr.	<u>Durham</u>	<u>New York</u>
<u>Warrenburg</u>	Univ. of N.H. Libr.	<u>Albany</u>
Library, Central Mo. State College	<u>Hanover</u>	Periodicals Section NY State Libr.
<u>Montana</u>	Baker Libr., Dartmouth College	<u>Binghamton</u>
<u>Billings</u>	<u>New Jersey</u>	Libr., State Univ. of NY
Libr., Eastern Montana College	<u>Madison</u>	<u>Brockport</u>
<u>Bozeman</u>	Friendship Library Fair Dickinson Univ.	State Univ. College at Brockport, Drake Mem. Libr.
Dept. of Econ., Mt. State Univ.	<u>New Brunswick</u>	<u>Bronx</u>
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<u>Kearney</u>	<u>Princeton</u>	Brooklyn Public Libr.
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<u>Canton</u>	Columbia University Watson Libr. of Bus. & Econ.	Univ. of Rochester Libr.
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Library, Pacific Northwest
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TVA, Technical Libr.

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Soc., Tx. A&M Univ.

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of Arts & IndustriesLubbockLibr., Lubbock Christian
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Tx. Tech. Univ., Agr.
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Luling

Luling Public Libr.

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State CollegeStephenvilleTarleton State College
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CollegeUtahCedar CitySouthern Utah State
College LibraryLoganMerrill Library, Utah
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MaryWashingtonBellinghamMabel Zoe Wilson Libr.
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CollegeOlympia

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Pullman

Wa. State Univ. Libr.

Seattle

Univ. of Wa., Libr.

TacomaMortvedt Library, Econ.
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<u>West Virginia</u>	<u>Whitewater</u>	Dept. of Agr. Econ. Univ. of Manitoba
<u>Morgantown</u>	Harold Andersen Libr. Wi. State Univ.	United Grain Growers, Ltd.
Agr. Eng. Library, Evansville Campus, WV Univ.	<u>Wyoming</u>	<u>New Brunswick</u>
<u>Princeton</u>	<u>Cheyenne</u>	<u>Fredericton</u>
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<u>Wisconsin</u>	<u>Laramie</u>	<u>Newfoundland</u>
<u>Eau Claire</u>	Div. of Agr. Econ. College of Agr.	<u>St. John's</u>
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Murphy Libr., Wi. State University	<u>CANADA</u>	<u>Halifax</u>
<u>Madison</u>	<u>Alberta</u>	<u>Truro</u>
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Accounting Div., The Northwestern Mut. Life Ins. Company	<u>Burnaby</u>	<u>Guelph</u>
Milwaukee Public Library	Simon Fraser Univ. Library, Acquisition Division - Serials	Dir., Canfarm Data System Econ. Br. Canada Agr.
Libr., Univ. of Wisconsin Milwaukee	<u>Vancouver</u>	McLaughlin Library Univ. of Guelph
Marquette Univ. Mem. Libr.	The Library, Univ., of British Columbia	Order Div., Library Univ. of Guelph
<u>Platteville</u>	<u>Victoria</u>	<u>Hamilton</u>
Dept. of Libr., Wi. State Univ.	Central Serials Records McPherson Library	Mills Mem. Library McMaster University
<u>River Falls</u>	<u>Manitoba</u>	<u>Kingston</u>
Wi. State Univ. Library	<u>Winnipeg</u>	Douglas Libr., Queen's Univ. at Kingston
<u>West DePere</u>	Elizabeth Dafoe Libr.	<u>London</u>
St. Norbert College, Libr.		Lawson Mem. Library

Ottawa

Carleton Univ. Libr.
Serials Dept.

Central Library-Serials
Univ. of Ottawa

Forest Econ. Res. Inst.
Dept. of Fisheries &
Forestry

Library - Statistics

Library, Canada Dept.
of Agr.

Library, Confederation
Building

Library, Dept. of
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Library - Environment

Sparks St. Div. Dept. of
Supply & Ser., Mins. Des
Appr. Et Services

Water Management Library

Peterborough

Serials Dept., Thomas J.
Bata Library

Ridgetown

Ridgetown College of
Agr. Tech.

St. Catharines

Library, Brock Univ.

Sault Ste Marie

Dept. of Fisheries &
Forestry, Ontario Reg.

Sudbury

Serials Dept. Laurentian
University, Library

Thunder Bay

Library, Lakehead Univ.

Toronto

Dept. of Municipal Affs.

Faculty of Forestry
Univ. of Toronto Libr.

Imperial Oil Ltd
Central Library

Library, Kates Peat
Marwick & Company

Library, Ontario Dept.
of Agr. & Food

Ontario Dept. of Rev.
Library

Univ. of Toronto
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Waterloo

Serials Dept., The Libr.
Univ. of Waterloo

Windsor

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Island

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Library, Univ. of PEI

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PEI Newstart Inc.

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MacDonald

The Library Dept.
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Bibliothèque, Ecole
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Comm.

Bibliothèque des Sci.
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LaRegie des Marches
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Serials Dept. McGill
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Sir George Williams
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Quebec

Dept. D'Economie Rurale
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Services des Periodiques
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Sherbrooke

Univ. de Sherbrooke
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Sask. Dept. of Agr.
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The Libr., Agr. Res.
Station

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Cairo

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Library, American Univ.
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UN Econ. Comm. for
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Dept. of Ag Econ.
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Lagos

Econ. Intelligence Libr.
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Zaria

Inst. for Agr. Res.

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Library, Njala Univ.
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- Ceylon
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- Libr., Natl. Inst. of
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- Central Library
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Nehru Krishi

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Rajasthan Univ. Libr.

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Jodhpur

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Officer in Charge
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Natl. Dairy Res. Inst.

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& Design Org.

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Shivaji University, Lib.

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Triplicane University
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U P Agricultural
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Punjabrao Krishi
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Phule Krishi Vidyapeeth

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Library, Directorate
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The Dir. of Instruction
College of Agriculture

Mysore Univ. Library

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Post

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Central Stat. Org.
Dept. of Statistics

Indian Agr. Res.
Inst. Library

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Librarian, TOK Sabha
Secretariat

Library, Jawaharlal
Nehru Univ.

Econ. & Stat. Adv.
Dept. of Econ & Stat.
Mins. of Food Agr.
Comm. Devl. & Coop.

National Council of
Applied Econ. Res.

Planning Commission
Library Yojana Bhavan

Indian Inst. of For.
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M&S Division, State
Trading Corp. of India,
Ltd.

Inst. of Applied
Manpower, Library

The Research Library
USAID/American Embassy

Planning Comm. Org.
The Under Secretary

World Bank

Orissa

Kanika Library
Ravenshaw College

<u>Utkal University Library</u>	<u>Tamilnadu</u>	<u>Tehran</u>
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<u>Pantnagar</u>	<u>Udaipur</u>	<u>Abu-Ghraib</u>
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<u>Parbhani</u>	<u>Vallabh Vidyanaagar</u>	<u>Baghdad</u>
The Principal, Govt. College of Agriculture	Librarian, Sardar Patel Library	Library & Public Rel. Ministry of Planning
<u>Patna</u>	<u>Varanasi</u>	The Library, Coll. of Admin. & Econ., Univ. of Baghdad
The Director, A. N. Sinha Inst. of Social Studies	Swadhyasthvir	Central Library The Univ. of Baghdad
<u>Poona</u>	Banaras Hindu University Library	<u>Mosul</u>
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Gokhale Inst. of Politics Economics	Dir., Agr. Econ. Res. Center, Visva Bharati	<u>Israel</u>
Librarian, College of Agriculture	The Univ. of Burdwan Library	<u>Ashkelon</u>
<u>Punjab</u>	The Librarian Visva-Bharati	Yehuda Dekel
Guru Nank University Library	The Principal Palli Siksha Sadana	<u>Haifa</u>
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<u>Rajahmundry</u>	<u>Ahwaz</u>	Industrial & Mgmt. Eng. Tech.
Director, Tobacco Res. Central Tobacco Res. Inst.	Central Library Univ of Gondi Shahpoor College of Agriculture	<u>Jerusalem</u>
<u>Ranchi</u>	<u>Karaj</u>	Bank of Israel Research Department
Head of the Dept. of Econ. Ranchi University	Library, Fac. of Agriculture	Minhal Mekarke Israel
<u>Surat</u>	<u>Shiraz</u>	The Jewish National & University Library
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<u>Rehovoth</u>	Noogaku-Bu-Fuzoku-Noojo Kyushu University	Obihiro Chikusan Daig. Library
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Rupin Inst. of Agriculture	Fukushima Ken Nogyo Shikenjyo	<u>Hyogo</u>
<u>Tel Aviv</u>	<u>Fukuyama</u>	The Libr. of Kwansei Gakuin University
Bank Leumi LeIsrael Ltd. Head Office, The Library	Chugoku Nogyo Shikenjo Higashi	<u>Ibaragi</u>
Econ. Planning & Devl. Center, Ministry of Agr.	Hiroshima Daigaku Suichikusan Library	The Ryutsu Keizai Daigaku Toshokan
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Tel Aviv Univ. Library Acquisitions Dept.	<u>Gunma</u>	<u>Ishikawa</u>
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<u>Ehimeken</u>	Hiroshima Nogyo Tanki Daigaku Toshokan	Kagoshima Daigaku Chuo-Toshokan
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Keizai, c/o Maruzen
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	<u>Yamagata</u>	Office of Rural Devl Library
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<u>Selangor</u>	<u>Laguna</u>	Express Distributors Div. of Express Cleaners
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and New Guinea

New Guinea Res Unit
Australian Natl Univ

Dept of Agr, Stock
and Fisheries

New ZealandAuckland

Univ of Auckland
Library

Canterbury

George Forbes Mem. Libr.
Lincoln College

Wellington

Central Library
D S I R

Dept of Agriculture
Library

Ryūkyū IslandsOkinawa

Univ of Ryukyus
Library

SOUTH AMERICAArgentina

INTA - E E A Anquill

Belcarce

INTA Estacion Exp
Agropecuara

Blanca

Instituto de Economia
Universidad Nac'l del
Sur

Banco Central de la
Republica Argentina
Biblioteca Reconquista

Estacion Expt. Agro-
pecuaria

Bibl Soc Rurale
Argentine

Direccion General de
Lecheria Biblioteca

Libreria Rodriguez

Oficina de Estudios Para
La Colaboracion Econ
Internac'l

Fundacao Getulio Vargas
Secretaria del Consejo
National de Desarrollo
Biblioteca

Univ de Buenos Aires
Fac de Agron y Vet.
Biblioteca

Univ de Buenos Aires
Fac de Ciencias Econ
Dto Biblioteca

Campana

INTA Estacion Esp
Agrapecuaria del Delta
Secretaria de Est de
Agr y Ganaderia de
la Nacion

Cordoba

Facultad de Ciencias
Econ., Biblioteca, Ciudad
Universitaria Est 32

Instituto de Ciencias
Agronomicas, Biblioteca

INTA Estacion Expt. Manfredi

La Plata

Biblioteca de Fac de
Agron de la Plata

Marcos Juarez

Estacion Exp Agropecuara
cede Correo 41

Mendoza

Inst Nac de Tec'n
Agropecuaria, Estacion
Exp Agro

Centro de Investigaciones
Economicas

Parana

INTA - Estacion Exp
Agro Parana

Pergamino

INTA - Estacion Exper
Agropecuaria

Resistencia

Instituto Agrotecnico
Biblioteca

Rio Negro

INTA Est Exp Agropecuaria
Alto Valle de Rio Negro

Rosario

Banco de la Nacion
Argentina, Rosario
Branch

Salta

Biblioteca, Universidad
Catolica de Salta

Santa Fe

Inst Nacl de Tech
Agropecuaria, Estacion
Exp Agropecuaria de

Tucuman

Univ Nacional de Tucuman
Facultad de Ciencias
Economicas

BrazilBahia

Centro De Pesquisas
do Cacau

Belo

ACAR - Centro

Botucatu

Biblioteca, Fac. de Cienc
Medicas e Biologicas
de Botucata

Brasilia

Bibl Camara Deputados

Banco de Desenvolvimento
do Espirito Santo

Fortaleza

Banco de Nordeste do
Brazil, Dept de Servicos
Admin

Chief of Party
Caixa Postal 158

Escola Agronomia UFC
Depto Economia

Minas Gerais

Biblioteca Central
Universidade Fed de Vicosa

Escola Sup. de Agr
de Lavras, Mins. da
Educacao e Cultura

Recife

Sudene - Div Document
Biblioteca

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IPEA

Sup Borracha ZC-P
Biblioteca

Salvador Bahia

Serv Infor Bibliogra-
ficas, Reitoria de Univ

Sao Paulo

Banco do Estado de
Sao Paulo, Biblioteca

Biblioteca de Escola
Superior de Agric

Fac Econ E Adm
Inst de Pesq Econ
Biblio, Univ de Sao
Paulo

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Sistemas

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ChileChillman

Biblio Escuela Agr
Univ de Concepcion

Santiago

Corp de Fomento de
la produccion, Biblio

Instituto de Econ.
Universidad de Chile

Inst de Investigac
Agro

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Nacional

UN Economic Comm for
Latin America

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Fac de Agronomia
Biblioteca

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de Chile
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Economia, Universidad
de Chile

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Chile
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Universidad de les
Andes

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Inst de Desarrollo
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Biblioteca, Centro
Internacional de Agr
Tropical (CIAT)

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EcuadorQuito

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Florida Mission INIAP

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Director of Agriculture
P O Box 1741

Turkeyen

Library - Periodical
Dept - University of
Guyana

PeruLima

Adela Investment Co
P O Box 207

Univ Nacional Agraria
Bibl Agricola Nacional
Dept de Adquisicones

SurinamParamaribo

Bureau Landelijke
Opbouw

Centre for Agr Res
in Surinam

UruguayMontevideo

Biblioteca de la
Facultd de Agronomia

IICA, Direccion Regional
Para La Zona Sur

VenezuelaCumana

Direccion General de
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Technology

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The Library, Univ.
Edgbaston

Boston

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Lending Library for
Science & Tech

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at the Univ of Sussex

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Ministry of Agriculture
Fisheries & Food

Univ of Bristol
Library

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Biology

Dept of Appl Economics

Library, Marshall Libr
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Library, Natl Econ Dvl
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Mins. of Overseas Devl. Library	Periodicals Dept. University Library	The Library Dept. of Agr. & Fisheries
School of Oriental & African Studies, Univ. of London	<u>Sheffield</u> Sheffield Polytechnic Library	<u>Galway</u> University College Library
The Natl. Inst. of Econ. and Social Research	The University Library Western Bank	<u>Londonderry</u> Library, New Univ. of Ulster
The Library IWS Wool House	<u>Southampton</u> The University Libr. Order Department	<u>Scotland</u> <u>Aberdeen</u> University of Aberdeen Sci. Library
Periodicals, Hendon College of Tech.	<u>Surrey</u> Overseas Devl. Dept. Plant Protection Ltd.	<u>Edinburgh</u> Library St. Andrew's House, Rm 02
University College Library	Library, Milk Mktg. Board	Edinburgh School of Agriculture Libr.
White Fish Authority	The Library, Land Resource Division	<u>Glasgow</u> The Andersonian Library, Univ. of Strathclyde
<u>Loughborough</u> Univ. of Nottingham School of Agriculture	<u>Warwickshire</u> The Library Univ. of Warwick	John Smith & Son Ltd Magazine Dept (for University Library)
<u>Maidenhead</u> Grassland Res. Inst.	<u>Great Britain</u> <u>Cambridge</u> Dept. of Applied Econ. Library	<u>St. Andrews</u> University Library
<u>Manchester</u> Lewis Library Univ. of Manchester	<u>Ireland</u> <u>Belfast</u> The Library Queens University	<u>Stirling</u> Periodicals Department Library
The Library, Main University, Univ. of Manchester	<u>Cork</u> The Library University College	<u>Wales</u> <u>Bangor Caerns</u> Science Librarian Univ. Coll. of N. Wales
<u>Melton</u> Brooksby Agr. College Library	<u>Dublin</u> Central Statistics Office	<u>Cards</u> General Library Univ. Coll. of Wales
<u>Norwich</u> Univ. of East Anglia University Plain	Faculty of Agr. Libr. University College	
<u>Oxford</u> Inst. of Econ. & Stat. Inst. of Ag. Econ Library		
<u>Reading</u> Dept. of Agr. Econ. Libr. University of Reading		

SUPPLEMENTARY INFORMATION
Geographical Analysis of Members and Journal Subscribers

Geographical Div.	1928		1961		1966		1971	
	Inds.	Librs.	Inds.	Librs.	Inds.	Librs.	Inds.	Librs.
U.S.	(590)	(161)	(2675)	(373)	(3288)	(545)	(3565)	(604)
AL	2	---	26	4	39	6	36	7
AK	---	---	2	---	6	1	6	1
AZ	---	1	27	2	36	3	47	2
AR	4	1	23	6	23	6	27	4
CA	22	9	181	33	197	57	202	48
CO	9	2	28	6	38	12	45	11
CT	11	5	24	6	31	8	35	11
DE	4	1	13	2	7	2	16	2
DC	89	8	197	26	221	38	402	31
FL	6	2	45	4	51	6	90	10
GA	6	4	31	9	37	10	60	9
HI	1	1	9	2	31	3	26	2
ID	4	2	18	3	16	---	19	4
IL	53	16	179	15	199	28	195	29
IN	15	3	95	5	120	6	179	14
IA	22	4	106	10	122	14	118	8
KS	9	3	52	5	49	6	51	9
KY	8	2	40	5	50	6	69	10
LA	3	1	45	8	40	11	50	11
ME	2	---	7	1	12	4	17	4
MD	12	1	95	5	162	10	109	15
MA	14	5	30	13	37	18	38	21
MI	7	2	115	6	119	13	139	20
MN	27	3	100	10	111	15	109	15
MS	2	3	20	5	18	9	20	7
MO	7	2	66	10	79	13	107	13
MT	7	4	30	5	28	3	31	4
NE	6	3	55	2	51	2	47	4
NV	2	---	9	1	16	5	18	4
NH	4	1	7	3	11	3	10	2
NJ	18	3	27	2	35	3	22	8
NM	3	1	21	3	26	4	36	3
NY	51	21	140	39	202	62	165	54
NC	3	1	66	5	76	8	82	12
ND	5	1	17	4	28	4	33	3
OH	28	5	78	15	103	19	101	21
OK	11	5	44	5	67	5	62	5
OR	9	1	27	4	36	8	56	12
PA	19	4	57	12	70	21	64	34
PR	---	1	12	5	9	9	4	7
RI	2	3	7	2	6	2	5	2
SC	4	1	16	4	24	3	29	5
SD	11	2	26	3	29	1	28	3
TN	6	3	48	12	52	13	80	14
TX	13	8	58	23	89	30	108	36
UT	5	2	22	3	25	6	21	5
VT	4	1	9	1	9	1	5	3
VA	10	3	210	6	251	9	147	16
WA	5	1	27	3	57	4	71	8
WV	3	1	13	1	19	2	18	2
WI	21	3	63	8	99	11	90	14
WY	1	1	12	1	19	2	20	5

Geographical Analysis of Members and Journal Subscribers
(continued)

Geographical Div.	1928		1961		1966		1971	
	Inds.	Librs.	Inds.	Librs.	Inds.	Librs.	Inds.	Librs.
CANADA	(10)	(13)	(129)	(34)	(162)	(43)	(214)	(67)
Alta	---	---	10	2	19	2	31	3
B.C.	1	3	4	2	7	2	10	7
Man.	---	2	19	3	25	4	51	3
N.B.	---	---	---	---	2	---	1	1
N'fd.	---	---	---	---	---	1	1	1
N.S.	---	1	3	---	3	1	3	3
Ont.	4	5	65	16	74	19	87	32
PEI	---	---	---	---	---	---	3	2
Queb.	3	1	15	8	13	10	7	12
Sask.	2	1	13	3	19	4	20	3
AFRICA	(4)	(5)	(17)	(34)	(107)	(58)	(72)	(79)
Alg.	---	---	---	---	---	---	---	1
Bots.	---	---	---	---	---	---	---	3
Cam.	---	---	---	---	1	---	2	---
Congo	---	---	---	---	---	---	1	2
Egypt	---	---	---	---	5	7	3	11
Eth.	---	---	---	---	4	2	---	6
Ghana	---	---	---	---	3	5	12	5
Ivo. Cst.	---	---	---	---	---	---	1	---
Kenya	---	---	---	---	32	4	1	4
Libr.	---	---	---	---	1	---	1	1
Libya	---	---	---	---	2	---	---	3
Maia.	---	---	---	---	7	1	4	5
Moro.	---	---	---	---	---	1	---	---
Nig.	---	---	---	---	23	9	9	11
Rhod.	---	---	---	---	1	3	---	3
S. Leone	---	---	---	---	---	---	2	1
Somali	---	---	---	---	1	---	---	---
S. Afr.	---	---	---	---	---	1	1	17
Sud.	---	---	---	---	3	2	---	2
Tanz.	---	---	---	---	6	1	2	1
Tun.	---	---	---	---	1	2	8	---
Uganda	---	---	---	---	11	1	11	1
Un. S.Afr.	---	---	---	---	4	17	---	---
Zambia	---	---	---	---	2	---	---	---

Geographical Analysis of Members and Journal Subscribers
(continued)

Geographical Div.	1928		1961		1966		1971	
	Inds.	Librs.	Inds.	Librs.	Inds.	Librs.	Inds.	Librs.
ASIA	(17)	(13)	(210)	(201)	(151)	(255)	(128)	(343)
Afgh.					1	---	2	---
Burma					1	1	---	1
Cam.					2	---	---	---
Ceyl.					1	4	1	4
China					---	1	2	5
H. Kong					---	2	---	---
India					32	76	20	113
Iran					2	2	3	6
Iraq					3	2	1	5
Isr.					20	11	7	16
Japan					23	107	11	138
Jor.					2	---	3	2
Kor.					14	8	15	11
Leb.					4	2	6	2
Mal.					3	6	1	10
Nepal					5	---	5	---
Pak.					4	13	12	7
Phil.					10	8	18	23
S. Arabia					---	---	1	---
Singapore					---	1	---	---
Taiwan					12	4	---	---
Thailand					9	7	17	---
UAR					3	---	---	---
Vietnam					---	---	3	---
AUSTRALIA & S. PACIFIC	(1)	(5)	(23)	(37)	(40)	(58)	(38)	(69)
ACT					4	5	3	9
NSW					18	19	12	21
N. Terr.					---	1	---	---
Queens.					1	2	2	3
S. Australia					---	4	5	6
Tas.					---	3	---	---
Vic.					8	8	5	12
W. Australia					2	2	---	5
Fiji					---	---	2	1
Guam					---	1	---	---
Indonesia					4	2	5	3
New Cal.					---	---	---	1
New Guinea					---	2	---	3
New Zealand					3	8	4	4
Ryuku Islands					---	1	---	1

Geographical Analysis of Members and Journal Subscribers
(continued)

Geographical Division	1928		1961		1966		1977	
	Inds.	Librs.	Inds.	Librs.	Inds.	Librs.	Inds.	Librs.
CENTRAL AMERICA	(1)	(1)	(25)	(14)	(37)	(23)	(19)	(15)
Barb.					1	1	--	--
Br. Hon.					1	--	--	--
Costa Rica					6	3	1	3
Dom. Rep.					1	--	8	--
El Salvador					3	3	1	1
Guat.					--	3	--	3
Haite					4	--	--	--
Honduras					3	2	1	2
Jam.					2	2	--	--
Mexico					11	8	5	1
Nic.					3	--	--	2
Panama					1	--	1	--
Trinidad					--	1	2	3
Windward Island					1	--	--	--

Geographical Analysis of Members and Journal Subscribers
(continued)

Geographical Division	1928		1961		1966		1971	
	Ind.	Libr.	Ind.	Libr.	Ind.	Libr.	Ind.	Libr.
EUROPE & UNK	(23)	(37)	(104)	(210)	(133)	(321)	(105)	(389)
Austria					---	2	1	---
Belgium					3	9	1	11
Bulg.					---	1	---	---
Cypr.					4	1	---	1
Czech.					---	1	---	---
Den.					2	9	1	8
Finland					1	6	---	5
France					11	32	8	49
Germany					7	45	6	48
Greece					11	4	9	9
Hungary					---	7	---	8
Italy					24	47	20	59
Lexembrough					---	---	---	1
Netherland					4	22	3	23
Norway					2	6	2	---
Poland					2	1	1	6
Portugal					---	3	---	3
Romania					1	1	---	1
Russia					1	13	---	17
Spain					7	13	11	26
Sweden					10	10	4	9
Switzerland					4	11	4	10
Turkey					11	5	8	7
Yugoslavia					1	17	---	17
England					19	40	19	54
Ireland					4	6	2	8
Scotland					3	6	4	7
Wales					1	3	1	2
SOUTH AM.	(0)	(1)	(54)	(45)	(75)	(69)	(77)	(80)
Argentina					15	25	14	28
Bolivia					1	1	---	---
Brazil					18	15	27	20
Chile					16	6	5	10
Colombia					4	4	15	6
Ecuador					3	1	2	2
Guyana					1	1	---	2
Paraguay					2	1	---	---
Peru					7	4	6	2
Surinam					1	2	---	2
Uruguay					3	4	---	2
Venezuela					4	5	8	6
TOTAL	646	236	3837	948	3993	1372	4218	1646

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Oklahoma City OK 73105

THE AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION AWARDS PROGRAM

The Awards Program of the American Farm Economic Association commenced in 1945 with an award for the best Journal of Farm Economics article and a special awards contest for papers on, "The Price Policy of Agriculture." It has been continued and expanded and now regularly includes awards for (1) research outstanding Journal (2) undergraduate teaching and (3) extension activities. Occasionally there are other special awards activities.

The Awards Program is supported and financed by funds donated by persons and firms interested in advancing research and scholarship in Agricultural Economics. The program is particularly supported by the Association's Sustaining Members.

AWARDS FOR RESEARCH IN AGRICULTURAL ECONOMICS

To recognize and encourage meritorious research in agricultural economics, ten awards will be offered in 1972 by the American Agricultural Economics Association. Seven awards will be \$250 each and three \$100 each.

Selection for the awards will be made from published research, doctoral theses, master's theses and articles in the American Journal of Agricultural Economics under the procedures outlined below. No one may receive more than one award in any one year, not an award in the same category more than once every three years. No publication shall be eligible for an award if its substantive equivalent has received an award in any category in an earlier year. All materials submitted should be in English or accompanied by an English translation.

Awards for Published Research

1. Three \$250 awards are offered for outstanding research publications in agricultural economics. These may include bulletins, articles, pamphlets and monographs, but not textbooks. Joint authors of a winning report will receive proportionate shares of an award so far as eligible.
2. Submissions are invited from areas such as farm management, marketing, prices, cooperation, finance, policy, theory, methodology, rural development, farm population, foreign agriculture, land and water economics, conservation, regional adjustment, international trade, economic history and state and local government, that throw significant light on the agricultural economy. Entries will be judged as a group rather than in particular areas.
3. Selections will be made from published research bearing a publication date in 1971.
4. Eligible recipients must be under 41 years of age at the time of publication but may have older joint authors.
5. Any paper authored or coauthored by a member of this awards subcommittee will be ineligible.
6. No penalty for joint authorship will be imposed unless one or more authors are over 41 years of age.
7. Each published report may receive only one award presented by the American Agricultural Economics Association in 1972. However, a report may be entered in more than one of the following categories: (a) outstanding articles in the American Journal of Agricultural Economics; (b) published research; (c) doctoral theses; and (d) Master's theses.
8. Thirteen copies of each publication should be submitted for consideration, unless expense to the individual is excessive.

9. The awards subcommittee for published research consists of 12 persons, in addition to the chairman, representing various fields. The members of the subcommittee will serve as voting judges, except the chairman, who will vote only in the event of a tie. The chairman of this subcommittee is J.O. Gerald, MED-ERS, U.S. Department of Agriculture, Washington, D.C. 20250.

10. Publications should be sent directly to the chairman of this subcommittee before February 15, 1972.

Awards for Doctoral Theses

1. Three \$250 awards will be available for theses prepared by candidates for the doctoral degree in any department engaged in training agricultural economists at the doctoral level.

2. An entry must be submitted by the head of the department where the thesis was presented in partial fulfillment of requirements for a degree. A department may submit one thesis for each twelve doctoral theses or fraction thereof presented, in agricultural economics, to a graduate school faculty in the year. In determining the number of eligible theses, departments should limit consideration to these of candidates who will receive a degree in agricultural economics and to theses of candidates who have taken agricultural economics as a field of emphasis.

3. Selection will be made from theses approved in final form by the student's advisory committee during the calendar year 1971, provided the candidate has met all other formal requirements for the doctoral degree.

4. A published thesis may be entered in both the published research and thesis classes but will be eligible for only one award. Although a published thesis is acceptable, a copy of the thesis as submitted to the graduate faculty should be sent whenever possible.

5. Three copies of a thesis must be sent to the subcommittee chairman. All copies will be returned after they have been read by the judges.

6. The awards subcommittee for doctoral theses will consist of 12 persons, in addition to the chairman. All members of the subcommittee will serve as voting judges, except the chairman who will vote only in the event of a tie. The chairman of this subcommittee is Joseph C. Purcell, Department of Agricultural Economics, Georgia Agricultural Experiment Station, Experiment, Georgia 30212.

7. Theses should be sent directly to the chairman of this subcommittee before February 15, 1972.

Awards for Master's Theses

1. Three \$100 awards will be available for theses prepared by candidates for the master's degree in any department engaged in training agricultural economists at the master's degree level.

2. An entry must be submitted by the head of the department where the thesis was submitted in partial fulfillment of requirements for a degree. A department may submit one thesis for each fifteen master's theses or fraction thereof presented to a graduate school faculty in the year. In determining the number of eligible theses, departments should limit consideration to theses of candidates who will receive a degree in agricultural economics and to theses of candidates who have taken agricultural economics as a field of emphasis. Departments are strongly encouraged to submit either ribbon copies, in the case of typewritten theses, or Xerox or other processed copies of comparable quality.

3. Selection will be made from theses approved in final form by the student's advisory committee during the calendar year 1971, provided the candidate has met all other formal requirements for the master's degree.

4. Three copies of a thesis must be sent to the subcommittee chairman. All copies will be returned after the committee has completed its work.

5. A published thesis may be entered in both the published research and thesis classes but will be eligible for only one award. Although a published thesis is acceptable, a copy of the thesis as submitted to the graduate faculty should be sent whenever possible..

6. The awards subcommittee for master's theses will consist of eight persons in addition to the chairman. All members of this subcommittee will serve as voting judges, except the chairman who will vote only in the event of a tie. The chairman of this subcommittee is Robert W. Herdt, Department of Agricultural Economics, University of Illinois, Urbana, Illinois, 61801.

7. Theses should be sent directly to the chairman of this subcommittee before February 15, 1972.

Award for Outstanding Article in the American Journal of Agricultural Economics

As has been the practice for a number of years, the editorial staff and the editorial council of the American Journal of Agricultural Economics, with the editor as chairman, will choose the most outstanding article published in the Journal during the preceding calendar year (in this instance 1971). The amount of this award is \$250.

Announcements of the 1971 awards will be made at the 1972 annual meeting of the American Agricultural Economics Association. Names of the recipients of the 1971 awards appear in the 1971 proceedings issue of the American Journal of Agricultural Economics.

AWARD WINNERS

1945

- A. Best journal article: Brewster, John M., "Farm Technological Advance and Total Population Growth," August 1945 issue of the Journal.
- B. Awards for papers on "The Price Policy for Agriculture," contest sponsored by AFEA from a private grant of funds (papers appeared in November 1945 issue of the Journal):

First prize	William H. Nichols
Second prize	D. Gale Johnson
Third prize	Frederick V. Waugh
Others receiving awards of \$250 each:	
George W. Barr	Carl C. Farrington
Merrill K. Bennett	Rudolph K. Froker
Gordon P. Boals	Charles D. Hyson
Karl Brandt	Adlowe L. Larson
Willard W. Cochrane	James G. Maddox
Robert J. Eggert	Rainer Schickele
Paul A. Eke	Geoffrey Shepherd
Lawrence H. Simerl	

1946

Best journal article: Hardin, Charles M., "The Bureau of Agricultural Economics Under Fire: A Study in Valuation Conflicts," August 1946 issue of the Journal.

1948

Best journal article: Cochrane, Willard W., "Farm Price Gyration-An Aggregative Hypothesis," May 1957 issue of the Journal.

1950

- A. Best journal article: Halcrow, Harold G., "Acturial Structures for Crop Insurance," August issue of the Journal.
- B. Outstanding Ph.D. theses:
 - 1. First prize: Foytik, Jerry, "The California Plum Industry-An Economic Study."
 - 2. Second prize:
 - a. Sayre, Charles R., "The Economics of Mechanization in Cotton Production."
 - b. Engleman, Gerald, "Some Economic and Physical Problems in the Marketing of Slaughter Hogs on the Basis of Carcass Weights and Grades in the United States."
- C. Outstanding published research reports:
 - 1. Salter, Leonard, "A Critical Review of Research in Land Economics."
 - 2. Johnson, D. Gale, "Forward Prices for Agriculture."
 - 3. Christensen, Raymond P., "Efficient Use of Food Resources in the United States."

1951

- A. Best journal article: Brewster, John M., "The Machine Process in Agriculture and Industry," February 1950 issue of the Journal.
- B. Outstanding Ph.D. theses:
 - 1. Clodius, Robert L., "An Analysis of Statutory Marketing Control Programs in the California-Arizona Orange Industry."
 - 2. Myers, Max, "Farm Tenure Processes in South Dakota."
 - 3. Williams, Donald B., "The Application of Economic Theory to the Field of Farm Management Research with Particular Reference to Recent Advances in Dynamic Economics."
- C. Outstanding published research reports:
 - 1. Johnson, D. Gale, "Trade and Agriculture."
 - 2. Luke, H. Alan, "Utilization and Pricing of Milk Under New York Marketing Orders."
 - 3. Bachman, Kenneth L. and Jones, Ronald W., "Sizes of Farms in the United States."

1952

- A. Best journal article: Waugh, Frederick V., "The Minimum-Cost Dairy Feed," August 1951 issue of the Journal.
- B. Outstanding Ph.D. theses:
 - 1. Thompson, Proctor, "Productivity of the Human Agent in Agriculture: An International Comparison."
 - 2. El-Shafie, Mohond A., "Population Pressure on Land and the Problem of Capital Accumulation in Egypt."
 - 3. West, Quentin M., "Some Alternative Sampling Techniques in the Measurement of Farm Business Characteristics."
- C. Outstanding published research papers:
 - 1. Fox, Karl A., "Factors Affecting Farm Income, Farm Prices and Food Consumption."
 - 2. Scoville, Orlin J., "Relationship Between Size of Farm and Utilization of Machinery, Equipment and Labor on Nebraska Corn-Livestock Farms."
 - 3. Burk, Marguerite C., "Changes in the Demand for Food from 1941 to 1950."

1953

- A. Best journal article: Working, Elmer J., "Appraising the Demand for American Agricultural Output During Rearmanent," May 1952 issue of the Journal.
- B. Outstanding Ph.D. theses:
 - 1. Fox, Karl A., "An Appraisal of the Applicability of Single Equation Methods to Statistical Demand Analysis for Agricultural Commodities."
 - 2. Gray, Roger W., "An Economic Analysis of the Impact of the Price Support Program Upon the Development of the Potato Industry in the United States."
 - 3. Thompson, William Neil, "Systems of Farming Adapted to Highly Productive Level Land in Illinois."
- C. Outstanding published reports:
 - 1. Bredo, William and Rojko, Anthony S., "Prices and Milksheds of Northeastern Markets."
 - 2. Heady, Earl O., "Economics of Agricultural Production and Resource Use."
 - 3. Johnson, Glenn L., "Burley Tobacco Control Programs-Their Over-all Effect on Production and Prices, 1933-50."

1954

- A. Best journal article: Hathaway, Dale E., "Agricultural Policy and Farmers' Freedom: A Suggested Framework," November 1953 issue of the Journal.
- B. Outstanding Ph.D. theses:
 - 1. Babbar, Madam M., "Statistical Approach in Planning Production Programs for Independent Activities."
 - 2. French, Benjamin C., "Economic Efficiency in California Pear Packing Plants."
 - 3. Sorenson, Vernon L., "A Study of the Nature and Cost of Government Programs Affecting Potatoes and Their Impact on Inter-Market Relationships."
- C. Outstanding published research reports:
 - 1. Fox, Karl A., "A Spatial Equilibrium Model of the Livestock-Feed Economy in the United States."
 - 2. Johnson, D. Gale, "Comparability of Labor Capacities of Farm and Non-farm Labor."
 - 3. Meinken, Kenneth W., "The Demand and Price Situation for Oats, Barley and Sorghum Grains."

1955

- A. Best Journal Article: Breimyer, Harold F., "Sources of our Increasing Food Supply," May 1954 issue of the Journal.
- B. Outstanding Ph.D. theses:
 - 1. Woodworth, Roger Charles, "Economic Analysis of Protein-Grain Substitution Relationships in Pork Production."
 - 2. Zellner, Norman, "An Economic Analysis of the California Prune Industry."
 - 3. Goreux, Louis M., "Agricultural Productivity and Economic Development in France (1852-1950)."
- C. Outstanding published research reports:
 - 1. Daly, Rex F., "Some Considerations in Appraising the Long-Run Prospects for Agriculture," published in "Long-Range Economic Projection," National Bureau of Economic Research. Submitted in the field of Theory and Methodology.
 - 2. Judge, George C., "Econometric Analysis of the Demand and Supply Relationships for "Eggs," Conn. Bull. 307. Submitted in the field of Agricultural Prices.

3. Swerling, Boris C., "California Agriculture and International Commodity Developments," published in a supplement to Monthly Review, Federal Reserve Board of San Francisco. Submitted in the field of Agricultural Policy.

1956

- A. Best journal article: Brandow, George E., "A Modified Compensatory Price Program for Agriculture," November 1955 issue of the Journal.
- B. Outstanding Ph.D. theses:
 1. Rhodes, V. James, "A Theoretical and Empirical Investigation of Consumer Preferences for Beef by Grades in Metropolitan St. Louis, 1954."
 2. Tang, Anthony M., "An Analysis of Southern Economic Development with Particular Reference to Agriculture: Upper Southern Piedmont, 1900."
 3. Tolley, George S., "Earnings of Labor and Capital in the Food Processing Industries."
- C. Outstanding published research reports:
 1. Hathaway, Dale E., "The Effects of the Price Support Program on the Dry Bean Industry in Michigan," Mich. Tech. Bul. 250
 2. Meinken, Kenneth W., "The Demand and Price Structure for Wheat," USDA Tech. Bul. 1136
 3. Ruttan, Vernon W., "The Impact of Urban-Industrial Development on Agriculture in the Tennessee Valley and the Southeast," published in the February 1955 issue of the Journal.
- D. Graduate students' contributed papers (published in December 1956 issue of the Journal):
 1. Goodwin, Dorothy C., "Fiscal Needs and Capacity of Connecticut Towns."
 2. Learn, Elmer W., "Estimating Demand for Livestock Products at the Farm Level."
 3. Mundlak, Yair, "Economic Considerations in the Design and Evaluation of Production Forecasts."
 4. Snodgrass, Milton M., "Linear Programming-A New Approach to Interregional Competition in Dairying."

1957

- A. Best journal article:
 1. Nerlove, Marc, "Estimates of the Elasticities of Supply of Selected Agricultural Commodities," May 1956 issue of the Journal.
 2. Waugh, Frederick V., "A Partial Indifference Surface for Beef and Pork," February 1956 issue of the Journal.
 3. Schultz, Theodore W., "Reflections on Agricultural Production, Output, and Supply," August 1956 issue of the Journal.
- B. Outstanding Ph.D. theses:
 1. Nerlove, Marc, "Estimates of the Elasticities of Supply of Corn, Cotton and Wheat."
 2. Evans, Homer C., "The Nature of Competition Among Apple Processors in the Appalachian Area."
 3. Bonnen, James Thomas, "United States Agricultural Capacity: A General Equilibrium Model for 1965."
- Honorable Mention:
 1. Ruttan, Vernon W., "The Contribution of Technological Progress to Farm Output: 1950-75," published in "The Review of Economics and Statistics" Vol. 38 (February 1956). Submitted in the field of General Agricultural Econ.

D. Graduate students' contributed papers:

1. Bird, Alan R., "The Effect of Agricultural Price Supports on the Balance of Payments in the United Kingdom."
2. Candler, Wilfred, "An Aggregate Supply Function for New
3. Mendelshon, Chaim, "Approaches to International Trade under Non-Pure Competition."

1958

A. Best journal article: Breimyer, Harold F., "On Price Determination and Aggregate Price Theory," August 1957 issue of the Journal.

B. Outstanding Ph.D. theses:

1. Candler, Wilfred V., "Linear Programming with Stochastic Yields."
2. Cromarty, William A., "Economic Structure of American Agriculture."
3. Nelson, Michael, "Economics of Increased Hay Production by Use of Nitrogen Fertilizer on Mountain Meadows in the Harney Basin, Oregon."

C. Outstanding published research reports:

1. Griliches, Zvi, "Hybrid Corn: An Exploration in the Economics of Technical Change," Vol. 25 of "Econometrica." Submitted in the field of Theory and Methodology.
2. Hathaway, Dale E., "Agriculture and the Business Cycle," published in "Policy for Commercial Agriculture," Joint Committee Print (85th Cong., 1st Sess., November 22, 1957). Submitted in the field of General Agricultural Economics.
3. Swerling, Boris C., "The World's Sugar: Progress and Policy," published- Stanford University Press, 1957. Submitted in the field of Agricultural Economics.

Honorable Mention:

1. Babb, E.M. and Butz, W.T., "Improving Fluid Milk Distribution Practices through Economic-Engineering Techniques," Pennsylvania Agricultural Experiment Station, Bulletin 622, June 1957. Submitted in the field of Agricultural Marketing.
2. Henry, William R. and Bishop, Charles E., "North Carolina Broilers in Inter-regional Competition." A.E. Information Series No. 56, Department of Agricultural Economics, North Carolina State College, February 1957. Submitted in the field of Farm Management and Production Economics.

D. Graduate students' contributed papers:

1. Dillon, John L., "Theoretical and Empirical Approaches to Program Selection Within the Feeder Cattle Enterprise."
2. Ram, Peretz, "An Input-Output Analysis of a Small Homogeneous Agricultural Area."
3. Uchida, Akira, "Technology Redefined-An Example of Quantitative Measurement in the Broiler Industry."

1959

A. Best journal article: Buse, Rueben C., "Total Elasticities-A Predictive Device," November 1958 issue of the Journal.

Honorable Mention:

1. Egbert, Alvin Charles, "Programming Regional Adjustments in Resource Use for Grain Production."
2. Gustafson, Robert L., "Carryover Levels for Grains."

3. Sammet, Loy L., "Economic and Engineering Factors in Agricultural Processing Plant Design."

Honorable Mention:

1. Edwards, Clark, "Resource Fixity, Credit Availability and Agricultural Organization."

C. Outstanding published research reports:

1. Johnson, Glenn Leroy, "Supply Function-Some Facts and Notions," published in "Agricultural Adjustment Problems in a Growing Economy," Iowa State College Press. Submitted in the field of Farm Management and Production Economics.
2. Nerlove, Marc, "Distributed Lags and Demand Analysis for Agricultural and Other Commodities," Agricultural Handbook No. 141, USDA. Submitted in the field of Theory and Methodology.
3. Renshaw, Edward Franklin, "Toward Responsible Government: An Economic Appraisal of Federal Investment in Water Resources Programs," Chicago: Idylla Press. Submitted in the field of Land and Water Economics and Conservation.

Honorable Mention:

1. Gaffney, M. Mason, "Urban Expansion-Will It Ever Stop?" Published in "Land" in 1958 Yearbook of Agriculture, USDA. Submitted in the field of Land and Water Economics and Conservation.
2. Griliches, Zvi, "The Demand for Fertilizer: An Economic Interpretation of a Technical Change," August 1958 issue of the Journal. Submitted in the field of Theory and Methodology.
3. Aplin, Richard D., "Country Reload Plants for Bulk Milk-Specifications and Costs," Cornell University Agricultural Experiment Station, AE-Res.-1. Submitted in the field of Marketing.

1960

- A. Best journal article: Brewster, John M., "The Impact of Technical Advance and Migration on Agricultural Society and Policy," December 1959 issue of the Journal.

B. Outstanding published research reports:

1. Andrews, Richard A., "A Study of the Sweet Corn Industry in the Midwest Farm Economy," published by the University of Minnesota Agricultural Experiment Station, St. Paul, Minn. Submitted in the General Agricultural Economics classification.
2. Hudson, James F., "Pricing Cotton Seed for Crushing," published by the Louisiana State University Agricultural Experiment Station, Baton Rouge, Louisiana. Submitted in the Agricultural Prices classification.
3. Miller, Walter G., "Comparative Efficiency of Farm Tenure Classes in the Combination of Resources," published by the USDA, ARS, Farm Economics Research Division. Submitted in the field of Land and Water Economics and Conservation.

C. Outstanding Ph.D. theses:

1. Dennis, Carelton C., "Interregional Competition in the Frozen Strawberry Industry."
2. Dillon, John L., "An Empirical Comparison of Theoretical and Actual Decision Making Under Uncertainty."
3. Moore, John R., "Market Structure and Competitive Behavior in the Dairy Industry."

Honorable Mention:

1. Johnson, Paul R., "Land Substitutes and Changes in Corn Yields."
2. Schoneman, J.A., "Effect of Variety and Harvest Date Systems on Economic Returns for Potato Farms in Central Wisconsin."

D. Outstanding M.S. theses:

1. Covey, C.D., "Some Considerations Affecting Producer Equity in the Florida Flue-Cured Tobacco Program."
2. Ehrich, R.R., "An Economic Analysis of Cash-Future Price Relationships of Hard Red Spring Wheat."
3. Lerner, E.B., "An Econometric Analysis of the Demand for Pecans with Special Reference to the Demand Inter-Relationships Among Domestic Tree Nuts."

Honorable Mention:

1. Nordhauser, Fred, "A Statistical Estimate of the Short-Run Price Elasticity of Demand for Fryers."

1961

A. Best journal article: Henry, William R. and Seagraves, James A., "Economic Aspects of Broiler Production Density," February 1960 issue of the Journal.

B. Outstanding published research reports:

1. Griliches, Zvi, "Measuring Inputs in Agriculture: A Critical Survey," published in the December 1960 issue of the Journal.
2. Lindsey, Quentin W., "Financing the Development of Commercial Farms," A.E. Information Series 77, June 1960; and "Transforming Low Income Farms into Profitable Commercial Farms," A.E. Information Series 76, May 1960, Department of Agricultural Economics, North Carolina State College.
3. Swerling, Boris D., "Toward Positive Policies for American Agriculture," published in "Food Research Institute Studies" Vol. 1, No. 3, Stanford University.

Honorable Mention:

1. Barker, Randolph and Heady, Earl O., "Economy of Innovations in Dairy Farming and Adjustments to Increase Resource Returns," Research Bulletin 478, Iowa State University, Ames, Iowa 1960.
2. Tolley, G.S. and Hartman, L.M., "Inter-Area Relations in Agricultural Supply," published in the May 1960 issue of the Journal.

C. Outstanding Ph.D. theses:

1. Day, R., "Recursive Programming and Production Response."
2. Drew, W.H., "Demand and Spatial Equilibrium Models for Fresh Apples in the United States."
3. Zusman, P., "Econometric Analysis of the Market for California Early Market Potatoes."

D. Outstanding M.S. theses:

1. Bryant, Wilfred Keith, "An Analysis of the Origins and Impacts of Inflation on Farm Input Expenditures, 1910-1958."
2. Countenay, Henry V., "An Analysis of Response Variation Encountered with Selected Interviewing Techniques in Consumer Marketing Research."
3. Tinley, William Allan, "Farm Inventory Valuation and Estimates of Aggregate Farm Income."

1962

A. Best journal article: Nerlove, Marc and Waugh, Frederick V., "Advertising Without Supply Control: Some Implications of a Study of the Advertising of Oranges November 1961 issue of the Journal.

B. Outstanding published research reports:

1. Bishop, Charles E., "Economic Aspects of Changes in Farm Labor Force," Chapter 4 of Labor Mobility and Population in Agriculture, Iowa State University Press, Ames, Iowa, 1961.

2. Gray, Roger W., "The Search for a Risk Premium," Journal of Political Economy, Vol. LXIX, No. 3, June 1961.
3. Ruttan, Vernon W., "The Impact of Irrigation of Farm Output in California," Vol. XXXI, No. 4, Hilgardia, California Agricultural Experiment Station, University of California, Berkeley, California, July 1961.

Honorable Mention:

1. Hartman, L.M. and Tolley, G.S., "Effects of Federal Acreage Controls on Costs and Techniques of Producing Flue-cured Tobacco," Technical Bulletin No. 146, North Carolina Agricultural Experiment Station, Raleigh, North Carolina, June 1961.
2. Loomis, Ralph A. and Barton, Glen T., "Productivity of Agriculture, United States, 1870-1958," Technical Bulletin 1238, Agricultural Research Service, U.S. Department of Agriculture, April 1961.
3. Stanton, Bernard F., "Seasonal Demand for Beef, Pork and Broilers," AMS-431, February 1961, printed by the Agricultural Marketing Service from Agricultural Economics Research, Vol. XIII, No. I, January 1961.

C. Outstanding Ph.D. theses:

1. Schuh, George Edward, "An Econometric Investigation of the Market for hired Labor in Agriculture."
2. Sparks, Willard R., "Estimates of the Demand for Food From Consumer Panel Data."
3. The third award is to be divided between:
Snyder, James Clare, "Management Models of Mathematical Programming."
Stollsteimer, John Fred, "Effect of Technical Change and Output Expansion on the Optimum Number, Size and Location of Pear Marketing Facilities in a California Pear Producing Region."

D. Outstanding M.S. theses:

1. Fletcher, Ronald G., "Time Series Analysis of Demand for Food."
2. Hermann, Robert O., "An Investigation of Differences in Income Elasticities of Demand for Food in Households of Differing Size and Composition."
3. Miller, Thomas A., "An Economic Analysis of Adjustment Opportunities on Dry Land Wheat Farms in Southeastern Wyoming."

1963

A. Best journal article: Breimyer, Harold F., "The Three Economies of Agriculture," August 1962 issue of the Journal.

B. Outstanding published research reports:

1. Dean, Gerald W. and Carter, Harold O., "Some Effects of Income Taxes on Large Scale Agriculture," Journal of Farm Economics, Vol. 44, August 1962.
2. Harlow, A. Arthur, Factors Affecting the Price and Supply of Hogs, USDA Tech. Bul. 1274, December 1962.
3. Sosnick, Stephen, "Orderly Marketing of California Avocados," Hilgardia, Vol. 33, December 1962.

C. Outstanding Ph.D. theses:

1. Boyne, David Herman, "Changes in the Real Wealth, Position of Owners of Agricultural Assets."
2. Burt, Oscar Raymond, "The Economics of Conjunctive Use of Ground and Surface Water."
3. Sisler, Daniel Gene, "Direct Production Payments in the Feed-Grain Livestock Sector of American Agriculture."

D. Outstanding M.S. theses:

1. Diehl, William David, "Analysis of Derived Demand for Hogs."

2. Hunt, James Baxter Jr., "An Economic Analysis of Optimum Flue-Cured Tobacco Production Practices Under Acreage Control and Poundage Control."
3. Lu, Yao-Chi, "Effect of Diversification on Price and Income Stability in Livestock Production."

1964

- A. Best journal article: Talbot, Ross B., "The USDA Embarks on Its Second Century of Service," August 1963 issue of the Journal
- B. Outstanding published research reports:
 1. King, Gordon A. and Schrader, Lee F., "Regional Location of Cattle Feeding-A Spatial Equilibrium Analysis, *Hilgardia*, Vol. 34, July 1963.
 2. Tolley, George S. and Giesman, Raymond W., "Consumer Demand Explained by Measurable Utility Changes," *Econometrica*, Vol. 31, July 1963.
 3. Walsh, Richard G. and Evans, Bert M., "Economics of Change in Market Structure, Conduct and Performance: The Baking Industry 1947-1958." University of Nebraska Studies, New Series No. 28, December 1963.
- C. Outstanding Ph.D. theses:
 1. Auer, Ludwig, "Impact of Crop-Yield Technology on United States Crop Production."
 2. Chapman, William Fred Jr., "Demand and Substitution Relationships for Florida and California Valencia Oranges Produced for Fresh Market."
 3. Oury, Bernard Roger Pierre, "A Tentative Production Model for Wheat and Feed Grains in France (1946-1961).
- D. Outstanding M.S. theses:
 1. Johnston, Warren E., "Regional Land Resources Required for Agricultural Supply-Demand Balance: A Study of Projection Sensitivity."
 2. Schreiner, Dean F., "Regional Adjustments in the Meat Industry to Changing Technology and Consumer Demand."
 3. Tyrczniewicz, Edward W., "An Econometric Study of the Regional Supply of Hired Labor to Agriculture."

1965

- A. Best journal article: Waugh, Frederick V., "Cobweb Models," November 1964 issue of the Journal.
- B. Outstanding published research reports:
 1. Griliches, Zvi, "Research Expenditures, Education and the Aggregate Agricultural Production Function," *Am. Econ. Rev.* 54:961-974, December
 2. Mundlak, Yair, "Long-Term Productions of Supply and Demand for Agricultural Products in Israel-General View and Summary," The Falk Project for Economic Research in Israel, 224 pp., May 1964.
 3. Waldorf, William H., "Demand for Manufactured Foods, Manufacturers' Services, and Farm Products in Food Manufacturing-A Statistical Analysis," USDA Tech. Bul. 1317, December 1964.
- C. Outstanding Ph.D. theses:
 1. Bell, Duran, Jr., "Models of Commodity Transfer with Special Reference to Lemon Industry."
 2. Gossling, William Frank, "A New Economic Model of Structural Change in U.S. Agriculture and Supporting Industries."
 3. Wells, Jerome C., "An Appraisal of Agricultural Investments in the 1962-68 Nigerian Development Program."

D. Outstanding M.S. theses:

1. Berry, James E., "Conventional and Unconventional Determinants of Market Performance."
2. Lee, Tsoung -Chao, "Alternative Procedures for Estimating Markov Chain Transition Probability Matrix from Aggregative Economic Data."
3. Sharp, Wayne W., "Application of a Dynamic Linear Programming Model for Optimum Use of Range Resources Over Time."

1966

A. Best journal article: Bonnen, James T., "Present and Prospective Policy Problems of U.S. Agriculture: As Viewed by an Economist," December 1965 issue of the Journal.

B. Outstanding published research reports:

1. Helmberger, Peter G. and Hoos, Sidney, "Cooperative Bargaining in Agriculture-Grower-Processor Markets for Fruits and Vegetables," University of California, Division of Agricultural Sciences, 1965.
2. Padfield, Harland and Martin, William E., "Farmers, Workers and Machines-Technological and Social Change in Farm Industries of Arizona," published for the Division of Economic and Business Research, College of Business and Public Administration, the University of Arizona. The University of Arizona Press, Tucson, 1965.
3. Ruttan, Vernon W., "The Economic Demand for Irrigated Acreage-New Methodology and Some Preliminary Projections, 1954-1980," published for Resources For The Future, Inc. by the Johns Hopkins Press, Baltimore, Maryland, 1965.

C. Outstanding Ph.D. theses:

1. Barnard, Jerald R., "Design and Use of Social Accounting Systems in State Development Planning."
2. Been, Richard O., "A Reconstruction of the Classical Theory of Location."
3. Boutwell, Wallace K., "Estimation of Consumer Demand Equations from Ordinally Separable Utility Functions."

D. Outstanding M.S. theses:

1. Bartholomew, Albert W., "An Analysis of the Interrelationships Between the Livestock and Feed Grain Industries: Exemplified by the Swine and Corn Industries."
2. Delvo, Herman W., "An Economic Appraisal of All-Risk Crop Insurance in North Dakota."
3. Prato, Anthony A., "An Econometric Analysis of the Monthly Farm Level Demand for Beef Cattle."

E. Awards for essays on "Effective Competition and Changing Patterns in the Marketing of Agricultural Products":

First prize: Paul, Allen B., "Pricing Below Cost in the Soybean Processing Industry."

Second Prize: Youde, James G. and Helmberger, Peter G., "Marketing Cooperatives in the U.S.: Membership Policies, Market Power and Antitrust Policy."

Third Prize: Williams, Willard F., "Toward Improved Performance in Agricultural Marketing Research."

First Honorable Mentions:

1. Babb, Emerson M., "Changing Marketing Patterns and Competition for Fluid Milk."
2. Beem, Eugene R. and Oxenfeldt, A.R., "A Diversity Theory for Market Processes in Food Retailing."
3. Brinegar, G.K. and Baker, C.B., "Welfare Gains and Changes in Food Procurement."

4. Knutson, Ronald D., "Cooperatives and the Competitive Ideal."
5. Morgan, Howard E., "Concentration in Food Retailing: Criteria and Causes."

Second Honorable Mentions:

1. Hiemstra, Stephen J., "Concentration and Competition in the Food Industries."
2. Moore, John R., "The Causes and Consequences of Major Changes in the Organization of Agricultural Marketing Activities."
3. Mori, H. roshi and Gorman, Wm. D., "An Emp. Investigation into the Relationship Between Market Structure and Performance as Measured by Prices."
4. Nelson, Paul E., Jr., "Price Competition Among Retail Food Stores-Theory, Practice and Policy Cues."
5. Roy, Ewell Paul, "Effective Competition and Changing Patterns in Marketing Broiler Chickens."

1967

- A. Best journal article: Ruttan, Vernon W., "Agricultural Policy in an Affluent Society," J. Farm Econ. 48:1100-20, Dec. 1966.

B. Outstanding published research reports:

1. Bawden, D. Lee, Carter, Harold O., and Dean, Gerald W., "Interregional Competition in the United States Turkey Industry," Hilgardia 37:13, June 1966.
2. Burt, Oscar R., "Economic Control of Groundwater Reserves," J. Farm Econ. 48:632-647, August 1966 Part 1.
3. Perkins, Brian B. and Hathaway, Dale E., "Movement of Labor Between Farm and Nonfarm Jobs," Michigan Agr. Exp. Station, Res. Bul. 13, 1966.

C. Outstanding Ph.D. theses:

1. Behrman, Jere Richard, "Supply Response in Underdeveloped Agriculture: A Case Study of Four Major Annual Crops in Thailand, 1937-1963," Massachusetts Institute of Technology, under the direction of Professor Franklin M. Fisher.
2. DeJanvry, Alain Choppin, "Measurement of Demand Parameters Under Separability," University of California at Berkeley, under the direction of Professor George M. Kuznets.
3. Tyrchniewicz, Edward W., "An Econometric Study of the Agricultural Labor Market," Purdue University under the direction of Professor G. Edward Schuh.

D. Outstanding M.S. theses:

1. Andorn, Reuven, "The Irreversible Demand Function for Beef," Oklahoma State University, under the direction of Professor J.W. Goodwin.
2. DeHaven, Ralph Kenneth, "Economic Evaluation of Alternative Milk Pricing Plans," University of Missouri, under the direction of Professor Stephen F. Whitted.
3. Patrick, George F., "The Impact of Managerial Ability and Capital Structure on Farm Firm Growth," Purdue University, under the direction of Professor Ludwig M. Eisgruber.

1968

- A. Best journal article: Eidman, Vernon R., Dean, Gerald W., and Carter, Harold O., "An Application of Statistical Decision Theory to Commercial Turkey Production," J. Farm Econ. 49:852-868, Nov. 1967.

B. Outstanding published research reports:

1. Dean, Gerald W. and Collins, Norman R., "World Trade in Fresh Oranges: An Analysis of the Effect of European Economic Community Tariff Policies," California Agr. Exp. Station, University of California, Davis, Giannini Foundation Monograph 18, Jan. 1967.
2. Colyer, Dale and Irwin, George, "Beef, Pork and Feed Grains in the Cornbelt: Supply Response and Resource Adjustments," Missouri Agr. Exp. Sta. Res. Bul. 921 (North Central Regional Research Publication No. 178), August 1967.
3. Mellor, John W., "Toward a Theory of Agricultural Development," in Agricultural Development and Economic Growth, ed. Southworth and Johnston, Cornell University Press, 1967, Chapter 2.

C. Outstanding Ph.D. theses:

1. Josling, Timothy E., "The United Kingdom Grains Agreement (1964): An Economic Analysis," Michigan State University, under the direction of Dale E. Hathaway.
2. Lu, Yao-Chi, "Variable Elasticity of Substitution Production Functions, Technical Change and Factor Shares," Iowa State University, under the direction of Lehman B. Fletcher.
3. Subotnik, Abraham, "The Development of an Econometric Model for Policy Decision Making in Israel," Cornell University, under the direction of Daniel G. Sisler.

D. Outstanding M.S. theses:

1. Raulerson, Richard C., "A Study of Supply-oriented Marketing Policies for Frozen Concentrated Orange Juice: An Application of Dynamo Simulation," University of Florida, under the direction of Dr. Max R. Langham.
2. Doeksen, Gerald, "An Input-Output Analysis of the Structure of the Economy of Oklahoma State University, under the direction of Dr. Charles H. Little.
3. Anderson, Marvin S., "An Econometric Investigation of the Demand Relationships for Soybean Oil in the Production of Margarine and Shortening," Purdue University, under the direction of Dr. Richard C. Haidacher.

1969

A. Outstanding Article in the journal: Schultz, T.W., "Institutions and the Rising Economic Value of Man," Am. J. Agr. Econ. 50:1113-1122, Dec. 1968

B. Outstanding published research reports:

1. Weyman, F. Helmut, "Dynamics of the World Cocoa Market, The MIT Press, 1968.
2. Houck, James P. and J.S. Mann, "An Analysis of Domestic and Foreign Demand for U.S. Soybeans and Soybean Products," Agricultural Experiment Station Technical Bul. 256, University of Minnesota, 1968.
3. Yotopoulos, Pan A., "Allocative Efficiency in Economic Development: A Cross-Section Analysis of Epirus Farming," Athens, 1968; Center of Planning and Economic Research; International Publications Service, New York.

C. Outstanding Ph.D. theses:

1. Lee, Teng-Hui, "Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960," Cornell University, under the direction of John Mellor.
2. Leunis, Joseph, "A Spatial Analysis of the United States Soybean Industry," University of Illinois, under the direction of George Judge.
3. Pineiro, Martin, "The Argentine Agriculture: Past and Potential Contribution to Country-Wide Economic Growth," University of California, Davis, under the direction of Chester McCorkle.

D. Outstanding M.S. theses:

1. Gunn, T.C., "Econometric Analysis of Post-War Demand for Farm Labor in the Northeastern United States," University of Connecticut, 1968.
2. Halvorson, M.P., "The Optimum Number, Size and Location of Turkey Processing Plants in a Three-State Area," Iowa State University, 1968.
3. Simmons, E.B., "The Food Balance Sheet as a Parameter of Tropical Food Economies: The Case of Mauritius," Cornell University, 1968.

1970

- A. Outstanding article in the journal: Thiesenhusen, William C., "Population Growth and Agricultural Employment in Latin America, with Some U.S. Comparisons," Am. J. Agr. Econ. 51:735-752, Nov. 1969.

B. Outstanding published Research reports:

1. Thorbecke, Erik and Field, Alfred J., "Relationships Between Agriculture, Nonagriculture and Foreign Trade in the Development of Argentina and Peru," chapter in the Role of Agriculture in Economic Development, Columbia University Press, 1969.
2. Zusman, Pinhas, Melamed and Katzir, Itzhak, "Possible Trade and Welfare Effects of EEC Tariff and "Reference Price" Policy on the European-Mediterranean Market for Winter Oranges," Giannini Foundation Monograph No. 24, University of California, 1969.

C. Outstanding Ph.D. theses:

1. Carlson, Gerald A., "A Decision Theoretic Approach to Crop Disease Prediction and Control," University of California, Davis.
2. Pinstrup-Andersen, Per, "The Role of Food, Feed and Fiber in Foreign Economic Assistance: Value, Cost and Efficiency," Oklahoma State University.
3. Behr, Michael Ross, "Technical Progressiveness in the Agricultural Processing Sector: A Structural Analysis," University of Wisconsin.
4. Gray, Sanford Lee, "Economic Effects of Diversion of the Columbia River," Washington State University.

D. Outstanding M.S. theses:

1. Nores, Gustavo A., "An Econometric Model of the Argentine Beef-Cattle Economy," Purdue University.
2. Wood, William Robert, "A Demand Analysis of Processed Salmon from the West Coast," Oregon State University.
3. Lynne, Gary Dean, "A Determination of Water Value Estimates for Bromegrass and Corn Silage Production in North Dakota," North Dakota State University.

1971

- A. Outstanding article in the journal: Schmitz, Andrew and Seckler, Davis, "Mechanized Agriculture and Social Welfare: The Tomato Harvester," American Journal of Agricultural Economics, 52:569-577, November 1970.

B. Outstanding published research reports:

1. Hayami, Yujiro and Ruttan, V.W., "Factor Prices and Technical Change in Agricultural Development The United States and Japan, 1880-1960," The Journal of Political Economy, 78:1115-1141, September/October 1970.
2. Shumway, Richard, King, Gordon A., Carter, Harold O. and Dean, Gerald W., "Regional Resource Use for Agricultural Production in California, 1961-65 and 1980, Giannini Foundation Monograph 25, University of California, September 1970.
3. Schuh, G. Edward, "The Agricultural Development of Brazil," New York, Praeger Publishers, 1970.

C. Outstanding Ph.D. theses:

1. Boehlje, Michael Dean, "Strategies for the Creation and Transfer of the Farm Firm Estate," Purdue University.
2. Prochaska, Frederick James, "Opportunity Cost of Time and Other Socio-Economic Effects on Away-From-Home Food Consumption," North Carolina State University.
3. Bekure, Solomon, "An Economic Analysis of the Intertemporal Allocation of Ground Water in the Central Ogallala Formation," Oklahoma State University.

D. Outstanding M.S. theses:

1. Lewis, Robert Clark, "The Marginal Cost of Alternative Levels of Water Quality in the Upper Mississippi River," University of Minnesota.
2. Liefer, James Arnold, "Attitude Toward Land Ownership and Usage in North Central New Mexico University.
3. Simunek, Richard Wayne, "An Evaluation of Age, Liquidity and Strategy on Inter-generation Farm Transfer Cost," Washington State University.

DISTINGUISHED UNDERGRADUATE TEACHER AWARDS

To recognize and encourage two meritorious performance in undergraduate teaching in agricultural economics, awards of \$250 is provided for presentation by the American Agricultural Economics Association upon recommendation of the selection committee. Nominations for this award may be made by an individual, a group of colleagues, or a department of agricultural economics by the submission of supporting materials according to the rules for this program. Renomination is invited if the materials are brought up to date and resubmitted.

Eligibility for Nomination

The nominee must

1. be actively engaged in teaching during the school year in which the nomination is filed with the selection committee.
2. have demonstrated outstanding ability as an undergraduate teacher of agricultural economics.

Basis of Selection

Each award will be made on the basis of

1. the nominee's ability to motivate and stimulate students;
2. the impression he has made upon his students by the mastery of his subject, his technique, his vision and his attitudes;
3. evidence of his interest in the improvement of teaching through publication and participation in professional meetings directed toward improved teaching;
4. contribution to undergraduate education outside of the classroom through counseling, student placement, advice to the departmental student club, and similar activities;
5. service to the undergraduate program of the educational institution through extracurricular activities other than those included above, such as membership on college committees, teaching improvement efforts and faculty leadership roles.

Materials to be Supplied by the Nominator

Six copies of the standard nominating form (supplied by the committee chairman) and required supporting materials.

Nominations

1. A nomination with supporting materials may be submitted by any individual, a group of colleagues, or a department. The committee chairman will provide the standard nominating form to department heads and chairmen. Others wishing to nominate may obtain forms from the committee chairman.
2. The selection committee for the Teacher Awards consists of six persons, either present or former undergraduate teachers, appointed for staggered terms, and will not include anyone nominated for the award. All members of the selection committee participate in the judging. The selection committee is empowered to recommend that no award be made if in their judgment none of the nominees is worthy of the award.
3. A nomination will be considered in either of two categories. The first category will include nominees who at the time of nomination have been engaged in undergraduate teaching for less than 10 years. The second category will include nominees who at the time of nomination have been engaged in undergraduate teaching for 10 years or more.
4. Nominations with supporting materials for the Teacher Awards should be sent by February 15, 1972, directly to the chairman of this subcommittee, John W. Malone, Jr., Chairman, Division of Agricultural and Resource Economics, University of Nevada-Reno, Reno, Nevada 89507.

AWARD WINNERS

	1965		1969
Hess, Carroll V., University of Minnesota.		Harrington, Albert H., Washington State University.	
	1966		
Kohls, Richard Louis, Purdue University.			1970
	1967	Taylor, Robert W., Purdue University.	
Warren, Stanley W., Cornell University.			1971
	1968	Goodwin, Oklahoma State University (less than 10 years)	
Beneke, Raymond R., Professor of Farm Management, Iowa State University.		Darrah, Lawrence B., Cornell University (10 years or more)	

DISTINGUISHED EXTENSION PROGRAM AWARD

To encourage the development of excellence in Extension economics work, the American Agricultural Economics Association will offer an award of \$250 in 1972. The award will be known as the Distinguished Extension Program Award. Nominations for the award may be made by any member of the American Agricultural Economics Association and selection will be made from among those nominated. An individual may be nominated or two or more individuals may be nominated jointly. It should be noted that the purpose of the award is to recognize an outstanding program achievement and not to recognize an individual or individuals for noteworthy service as Extension economists over an extended period of time.

Each nomination must be made by separate letter to the Extension Award Selection Committee by April 1, 1972, accompanied by four copies of documentary evidence of the achievement of the person or persons nominated. Documentary evidence of the achievement of the person or persons nominated should include an adequate presentation of the following points, in this order: (1) name(s) and title(s) of the person or persons nominated, (2) the problem about which the person or persons nominated built their Extension program and the objective(s) of the program, (3) clientele served, (4) the program developed to attain the objective(s), including analytical tools and techniques and education methods and procedures used, and (5) program accomplishments in terms of clientele response and/or establishment of the validity of an Extension technique. If two or more persons are nominated jointly, the specific contribution of each to the Extension program must be documented.

In order to be eligible for nomination, an individual or individuals must have had primary responsibility for the Extension program which supports the nomination. The program must have been active within one year of the date of the nomination, and its subject matter content must be principally in the field of economics.

Each nomination will be evaluated on the quality of the program which supports the nomination, using the documentary evidence submitted with the nomination as the sole basis for making this evaluation. Equal weight will be given each of the following five characteristics of the program:

1. Originality in selection of the problem and the application of economic principles, tools of analysis, and extension techniques to its solution.
2. Its effectiveness as a catalyst to other Extension economists in embarking on new programs or in applying new concepts to existing programs.
3. Its contribution to greater proficiency of Extension personnel in economics programs.
4. Its effectiveness in bringing about a significant change in behavior and/or understanding of the clientele.
5. Originality in recognizing educational opportunities which lend themselves to use in an Extension economics program.

Material should be sent to the subcommittee chairman, Gene McMurtry, Hutcheson Hall, Virginia Polytechnic Institute, Blacksburg, Virginia 24061.

AWARD WINNERS

1966

Winner: Ogg, Wallace E., Thomas, J. Robert, Paulsen, A. Arnold, Donhowe, Charles E., "Financing Iowa's Public Services," Iowa State University.

Honorable Mention:

1. Schermerhorn, R.W., "Management of Agricultural Marketing and Land and Water Based Recreational Firms," University of Maryland.
2. Bottum, J. Carroll, "Community Development in Indiana," Purdue University.

1967

Oesterle, Eric, Purdue University.

1968

1. Kohlmeier, J.B. Purdue University
2. Smith, Francis J., University of Minnesota

1969

1. McMurtry, Gene, Virginia Polytechnic Institute
2. Hadley, Noah, Purdue University

1970

1. Harl, Neil E., Iowa State University
2. Duft, Kenneth D., Washington State University

1971

Armstrong, J.H. and Courtenay, H.V., Purdue University

EXTENSION PUBLICATION AWARD

To encourage and recognize excellence in Extension economics work, the American Agricultural Economics Association will offer an award of \$250 in 1972. This award will be known as the Extension Publication Award.

Eligibility for the Award

This award is open to any professional agricultural economist; however, the nomination must be made by a member of the American Agricultural Economics Association. Any type of published material shall be eligible for the award.

Nominations for the Award

Each nomination for the Extension Publication Award must be signed by the nominator and include

1. the name or names of persons nominated;
2. a concise statement of the problem about which the publication is written;
3. a statement revealing the direct applicability of the publication to an ongoing Extension program;
4. identification of the audience for whom the publication was intended;
5. copies of the publication.

Criteria for Judging Nominations

1. Clarity of the problem statement about which the publication is written.
2. Completeness and conciseness of the analysis in the publication.
3. Adaptability of the publication to the audience for whom it was intended.
4. Contribution to the body of knowledge available for direct use in Extension economics programs.
5. Relevance to a current problem.
6. Timeliness and effectiveness in its intended purpose.

AWARD WINNERS

1971

Carroll, William M., Pennsylvania State University

THE BEGINNINGS OF THE AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION

Farm economics as a profession is a development of the present century. The extent of the growth of this profession is in some measure indicated by the large membership of the American Farm Economic Association. Before the turn of the century an interest in the economic problems of farmers had been manifest but there had been no professors of farm economics. The rapid growth of the Grange and the Farmers' Alliance had given notice of a keen interest in farm economic questions. Editors of farm journals, Luther Tucker of the Country Gentlemen, Orange Judd of the Orange Judd Farmer, C.B. Murray of the Cincinnati Price Current, and Uncle Henry Wallace of Wallaces' Farmer, were giving considerable space to the economic problems of farmers. Between 1840 and 1900 the U.S. Government was developing services which provided exceedingly valuable material for the farm economists when they arrived on the scene. The census of 1840 and succeeding decades, in the growth of which F.A. Walker and W.H. Brewer made invaluable contributions, provided the basic material for the study of the growth of American agriculture. The Department of Agriculture, in which J.R. Dodge, J.S. Morton, F.H. Hitchcock, G.K. Holmes, and others worked effectively, made important contributions in that period not only in developing statistical services but also in the treatment of economic problems of production, marketing, and foreign trade in farm products.

In the 1890's, university professors, Richard T. Ely, Liberty Hyde Bailey, and others, were brooding over this subject. Professors of agriculture, I.P. Roberts for example, and more specifically professors of agronomy, Thomas F. Hunt and Willet M. Hays, were offering courses in rural economics and farm management. But it was the first decade of the twentieth century that saw the beginnings of farm economics as a full time job for a college professor. The interest became widespread but there were few men available with special training for economic research and teaching in this field. Hence, at first the growth was slow. Men whose training had been in agronomy, animal husbandry, or general economics found themselves interested in farm economics and went to work in this new field. Some were interested in farm organization and management, others were especially interested in land tenure, cooperative marketing, or farm credit. Most of them could at first give only part time to this subject, but each made such contribution as he could. The subject gained in prestige, and before the end of the decade several professors were giving full time to the subject.

Since only a few of the names of that day will be found in the present membership list of the American Agricultural Economics Association, it seems fitting to include here the names of some of those who pioneered in farm economics in the first decade of the present century: E.F. Adams, Leroy Anderson, Frank App, T.C. Atkeson, Andrew Boss, K.L. Butterfield, A.E. Cance, T.N. Carver, F.W. Card, T.P. Cooper, J.L. Coulter, D.H. Doane, J.R. Fain, G.T. Fairchild, J.A. Foord, F.D. Gardner, M.B. Hammond, Harry Hayward, B.H. Gibbard, G.N. Lauman, K.C. Livermore, David Lubin, J.B. Morman, D.H. Otis, E.C. Parker, H.C. Price, C.W. Pugsley, W.J. Spillman, H.C. Taylor, R.P. Teele, C.W. Thompson, J.C. Thompson, E.H. Thomson, G.F. Warren, E.H. Webster.

Because of the growing interest, the American Economic Association held several sessions on agricultural economics from 1897 to 1912 in connection with its annual meetings. In the meantime teachers of farm management began independent development of work in farm economics and in 1910 organized the American Farm Management Association. This Association proved to fill an important place and usually held its meetings in conjunction with the meeting of the Association of Agricultural Colleges and Experiment Stations.

From 1913 to 1916 the American Farm Management Association and the National Conference on Marketing and Farm Credits, which met annually at Chicago, were the principal organizations in the United States for the discussion of questions relating to agricultural economics. The National Conference on Marketing and Farm Credits gradually came to include the whole field of agricultural economics. Marketing officials and agricultural economists who felt the need of uniting their interests organized the National Association of Agricultural Economics in 1916.

The National Association of State Marketing Officials decided not to hold its meeting in 1917, and a movement was inaugurated to unite the State Marketing Officials with the Agricultural Economists. The National Conference on Marketing and Farm Credits also decided that its work was completed.

In 1917 both the National Association of Agricultural Economists and the American Farm Management Association met with the American Economic Association and at this time consolidation of the two associations was first proposed. In 1919 the two associations merged under the name, American Farm Economic Association. In 1968, the name was changed to the American Agricultural Economics Association.

In January 1919 the American Farm Economic Association voted to publish a quarterly journal, and the first number appeared in June 1919.

While some very effective work had been done in farm economics prior to 1912, T.N. Carver described agricultural economics of that date as "an aspiration." Since then agricultural economics as a profession has become a definite reality. But may we not truly say that the solution of major economic problems of farmers is still an aspiration? The great work lies ahead.

CHARTER MEMBERS

"Sections of the American Economic Association in the 1890s and in 1907 and 1908 represent informal precursors of the AFEA. The same may be said of an informal group meeting at Cornell in 1908. However, the appropriate founding date of the association is July 28, 1910, the time of a meeting held at Iowa State College which established the American Farm Management Association."

So reported O.C. Stine, Stanley Warren and Lawrence Witt in 1957 as members of the Association's committee on commemoration of the 50th Anniversary.

As noted in the foreword to this Handbook, the American Farm Management Association (formed in 1910) and the National Association of Agricultural Economists (organized in 1916) merged in 1919 under the name of American Farm Economics Association. members of both associations as of 1919 therefore may be considered charter members of AFEA. "Charter" members of AFEA are therefore defined as members of the American Farm Economic Association in 1919-20. Records are incomplete. It is believed that total membership of AFEA in 1919-20 was approximately 600. The following list of 430 "charter" members as defined above was developed by R.G. Bressler.

Abell, M. F.	Brodie, D. A.	Crosby, M. A.	Fortuyn, L. D.
Adams, R. L.	Bronson, W. H.	Crow, J. W.	Fox, D. S.
Allbaugh, L. G.	Brossard, E. B.	Currier, E. L.	Fraser, W. J.
Allen, F. L.	Brown, E. A.	Curry, B. E.	Fratt, G. N.
Allred, C. E.	Browning, Robert	Cutler, J. C.	Frear, D. W.
Anderson, A. E.	Bruce, G. W.	Dadisman, A. J.	Frowley, J. W.
Anderson, E. F.	Brunson, E. B.	Dadisman, A. T.	Funk, W. C.
Anderson, E. O.	Bugby, M. O.	Dagger, G. N.	Gabrici, L. D.
Anderson, E. W.	Bull, S. L.	Davis, I. G.	Galpin, C. J.
Anderson, Leroy	Burdick, R. T.	Dean, W. H.	Gardner, F. D.
Anderson, O. L.	Burford, G. S.	Dickey, J. B. R.	Garey, L. F.
Andrews, J. B.	Burritt, M. C.	Dixon, H. M.	Garrison, J. H.
Andrews, M. E.	Buttler, W. R.	Doane, D. H.	Gates, Frederick
App, Frank	Bye, F. P.	Dodge, L. G.	Geismar, L. M.
Arnold, J. H.	Carncross, E. A.	Doherty, W.T.K.	Geldenhuys, F. E.
Ashby, W. W.	Case, H. C. M.	Donald, J. S.	Genung, A. B.
Ashton, T. H.	Cates, C. S.	Drake, J. A.	Gilbertson, H. W.
Ausman, L. V.	Cates, H. R.	Duryee, W.B. Jr.	Gillett, R. L.
Ayres, O. L.	Cates, J. S.	Dynes, R. C.	Gittings, C. C.
Baker, H. J.	Cavert, W. L.	Eastman, J. F.	Gittings, E. J.
Baker, O. E.	Chapin, R. W.	Eastman, M. G.	Goddard, L. H.
Ball, J. S.	Chase, C. F.	Edwards, Harold	Goldenhuys, F. E.
Ballard, F. L.	Chase, F. J.	Eldred, A. R.	Goldenweiser, E. A.
Balmer, F. E.	Cheeseman, J. B.	Eldredge, B.	Goodrich, C. L.
Barron, J. H.	Chubbuck, Levi	Eliot, H. M.	Grant, C. J.
Bassett, L. B.	Chubbuck, M. E.	Elser, W. L.	Gray, L. C.
Becker, J. A.	Churchill, C. O.	Ely, R. T.	Grantham, A. E.
Beeson, M. A.	Clapp, F. C.	Emerson, A. E.	Graves, C. H.
Benedict, M. R.	Clark, A. L.	Engberg, R. C.	Green, R. M.
Bennett, C. M.	Clark, C. P.	Enz, J. F.	Greene, H. F.
Benton, A. H.	Cleland, S. B.	Erdman, H. E.	Greene, M. H.
Billings, G. A.	Clinton, L. A.	Evans, R. J.	Grimes, W. E.
Black, J. D.	Clothier, R. W.	Eyerly, E. K.	Grunwald, Kurt
Boeger, E. A.	Coffey, G. N.	Fain, John R.	Gulick, F. H.
Boomer, G. R.	Connor, L. G.	Falconer, J. I.	Gunn, R. V.
Boss, Andrew	Cook, William	Farrell, F. D.	Hamilton, C. H.
Bowles, P. S.	Cooper, M. O.	Fassett, H. G.	Hammond, Girard
Bowman, A. E.	Cooper, M. R.	Filley, H. C.	Handschin, W. F.
Boyle, L. F.	Cooper, T. P.	Fisher, M. L.	Hankinson, J. H.
Bradlee, Thomas	Corbett, L. L.	Fluharty, L. W.	Harding, H. A.
Bradley, L. P.	Cotton, J. S.	Foard, W. E.	Harper, J. N.
Branch, F. H.	Cox, A. B.	Foord, W. D.	Harris, A. L.
Brand, R. E.	Cox, H. R.	Foristall, E. H.	Harris, F. S.
Bridgeforth, G. R.	Cronwell, A. D.	Forster, G. W.	Harter, W. L.

Harvey, L. E.	Lyons, F. F.	Peck, W. A.	Sylvester, W. W.
Haskell, E. S.	MacDougall, A.F.	Pence, M. O.	Taber, R. F.
Hauter, L. H.	Macklin, T.	Peterson, P. E.	Taliaferro, W.T.L.
Hawthorn, H. W.	Magid, L. B.	Phillips, L. S.	Taylor, C. C.
Hays, W. M.	Magruder, D. G.	Phillips, T. D.	Taylor, E. L.
Hayward, Harry	Magruder, R. H.	Pond, G. A.	Taylor, F. W.
Heilman, W. H.	Manchester, A.W.	Preston, C.F.	Taylor, H. C.
Hennis, C. M.	Mayland, E.	Price, H. B.	Teneyck, A. M.
Hibbard, B. H.	Marquis, J. C.	Prince, F. S.	Thomas, E. H.
Hibberd, G. H.	Marshall, F. J.	Pugsley, C. W.	Thompson, A. L.
Hibshman, E. H.	Marshall, J. D.	Pullen, J. S.	Thompson, E. H.
Hill, W. D.	Martindale, R. V.	Rankin, J. O.	Thompson, R. N.
Hillequist, H. M.	McCabe, E. D.	Rasmussen, M. P.	Thompson, S. H.
Hobson, A.	McClure, H. B.	Rauchenstein, E.	Thomson, E. H.
Holmes, C. L.	McCulloch, M.E.	Rayner, O.S.	Thomson, S. M.
Hope, C. E.	McDonald, B. A.	Reed, C. P.	Tibbitts, F. M.
Horlick, A. J.	McDowell, J. C.	Reed, W. G.	Tolley, H. R.
Horlick, William Jr.	McKee, J. M.	Rhoades, E. L.	Torblaa, E. M.
Hover, C. L.	McLeod, J. H.	Richards, D. J.	True, G. H.
Howe, F. W.	McNair, A. D.	Robertson, F.E.	Tubbs, W. J.
Howell, L. G.	McNail, P. E.	Robertson, L.S.	Turner, Frank
Huey, C. G.	McMillan, S.A.	Robinson, G.H.	Turner, H. A.
Hughes, D. D.	Meeker, F. N.	Robinson, L.E.	Turpin, G. M.
Hughes, H. D.	Mendum, S. W.	Rockwell, F.F.	Uber, J. E.
Humphrey, H. N.	Miller, A. E.	Rogers, H. B.	Vanderbilt, W.S. Jr.
Hunter, Byron	Miller, C. E.	Ross, A. B.	Van Norman, H. E.
Hutson, J. B.	Miller, G. H.	Roper, F. A.	Van Pelt, D. H.
Iberico, J. R.	Miller, H. A.	Rothenberg, W.H.	Van Schoik, R. H.
Jardine, W. M.	Miller, R. N.	Rulison, H.K.	Vass, A. F.
Jayne, S. O.	Misner, E. G.	Rundles, J. C.	Voorhees, J. H.
Jeffers, H. W.	Monroe, C. F.	Sarle, C. F.	Wakeley, L. M.
Jeffery, J. A.	Montgomery, C.W.	Schempp, G.C. Jr.	Waller, A. G.
Johnson, E. C.	Montgomery, Frank	Scoville, G.P.	Wallis, H. M.
Johnson, J. M.	Moorhouse, L. A.	Scudder, H.D.	Warfield, Edwin Jr.
Johnson, M. B.	Morgan, H. A.	Severance, George	Warner, E. S.
Johnson, O. M.	Morgan, J. O.	Shaw, C. F.	Warren, G. F.
Johnson, O. R.	Mowry, H. H.	Sheay, J. P.	Washburn, R. S.
Johnson, W. A.	Mumford, Eben	Sherpardson, J.E.	Webster, E. H.
Jones, Earl	Mumford, H. W.	Short, A. K.	Wendt, G. H.
Jones, J. L.	Munger, H. B.	Simmons, G. E.	Wheeler, H. J.
Jones, M. D.	Myers, W. I.	Slovan, J. J.	Whelpton, P.K.
Jorgensen, B.C.B.	Nathan, A. N.	Smith, A. G.	Whitson, Jay
Juve, O. A.	Needham, R. A.	Smith, C. B.	Wilcox, E. V.
Kephart, L. W.	Newman, C. L.	Smith, E. L.	Wilcox, R. H.
Keyes, H. F.	Newton, L. W.	Smith, J. R.	Wilder, H. J.
Kezer, Alvin	Nicholls, W.D.	Smith, Morell	Willard, J. D.
Kidder, A. F.	Nichols, G.R. Jr.	Smith, S. G.	Willard, R. E.
Kilgore, B. W.	Noble, C. V.	Smith, W.S.A.	Williams, C.B.
Kirkpatrick, K.A.	Norling, A. L.	Southwick, B. G.	Williams, H. F.
Knowlton, F. L.	Norton, L. J.	Spafford, R. R.	Wilson, A. D.
Krauss, F. G.	Nuckols, A. B.	Spillman, W. J.	Wilson, C. A.
Ladd, C. E.	Oates, M. B.	Stanford, E. A.	Wilson, M. C.
Lauck, W. H.	Oleson, N. A.	Starr, S. H.	Wilson, O. A.
LaFeber, John	Olin, W. H.	Stevens, F. D.	Wilson, W. H.
Lehman, H. A.	Orcutt, J.C.	Stewart, C. L.	Winsor, L. M.
Leitch, A.	Ostrander, W.A.	Stewart, R. L.	Wood, D. C.
Leth, R. J.	Otis, D. H.	Stine, O. C.	Wooton, E. O.
Linfield, F. B.	Parker, W. B.	Stitts, T. G.	Working, D.W.
Lippitt, W.D.	Pats, H. O.	Stone, W. E.	Wright, R. V.
Livermore, K. C.	Patterson, H.F.	Strait, E. D.	Yerkes, A. P.
Livingston, George	Pearson, F. A.	Strait, H. G.	Young, E. C.
Lloyd, O. G.	Pease, R. W.	Stuart, D.	Young, H. P.
Lloyd, W. A.	Peck, F. W.	Summers, T. H.	Youngblood, B.
LoveLand, E. H.		Sweet, Lou D.	Zang, A. J.

FELLOWS
of the
AMERICAN FARM ECONOMIC ASSOCIATION

John David Black
Thomas Nixon Carver
Joseph Stancliffe Davis
Garnet Wolsey Forster
Asher Hobson
Edwin Griswold Nourse
Theodore W. Schultz
Henry Charles Taylor
Frederick V. Waugh
Milburn Lincoln Wilson
Mordecai Joseph Brill Ezekiel
Oscar B. Jesness
William Irving Myers
Harold Clayton M. Case
Oscar Clem Stine
Leonard Knight Elmhirst
Sherman Ellsworth Johnson
Oris Vernon Wells
Ernest Charles Young
Hugh Bruce Price
Murray Reed Benedict
Earl O. Heady
Raymond George Bressler, Jr.
Karl Brandt
Foster Floyd Elliott
Joseph Ackerman
Bushrod Warren Allin
William Wesley Cochrane
George Hubert Aull
George E. Brandow
J. Carroll Bottum
Forest Frank Hill
Harry C. Trelogan
William Hord Nicholls
D. Gale Johnson
Elmer Joseph Working
Maurice M. Kelso
John F. Booth
Walter W. Wilcox
James G. Maddox
Nathan M. Koffsky
Glenn Leroy Johnson
Marion Clawson
Charles Edwin Bishop
Don Paarlberg
Rainer Schickele
D. Howard Doane

Annual Meetings and Officers of the American Agricultural Economic Association
(including its predecessors, the American Farm Management Association)
(and American Farm Economic Association)

Meeting	Year	Place	Officers in charge of this meeting (elected at preceeding meeting)		
			President	Vice Presidents	Secretary-Treasurer
1st	1910	Ames, Ia.	W.J. Spillman	D.H. Otis	G.F. Warren
2nd	1911	Columbus, Oh.	(Same officers were in charge of this meeting)		
3rd(Jan)	1913	Wash., DC	(Same officers were in charge of this meeting)		
4th(Nov)	1913	Wash., DC	G.F. Warren	Andrew Boss	C.L. Goodrich
5th	1914	Wash., DC	D.H. Otis	W.M. Jardine	G.A. Billings
6th	1915	Berkeley, Ca.	Andrew Boss	J.A. Foord	G.A. Billings
7th	1916	Wash., DC	H.A. Morgan	H.W. Jeffers	G.A. Billings
8th	1917	Philadelphia, Pa.	H.W. Jeffers	F.W. Peck	G.A. Billings
9th(Jan)	1919	Baltimore, Md.	G.A. Billings	J.R. Fain	K.C. Livermore
10th(Nov)	1919	Chicago, Il.	J.R. Fain	L. Moorehouse	F.W. Peck
11th	1920-21	Wash., DC	H.C. Taylor	W.F. Handschin	F.W. Peck
12th	1921	Pittsburgh, Pa.	W.F. Handschin		J.I. Falconer
13th	1922	Chicago, Il.			
14th	1923	Wash., DC.			
15th	1924	Chicago, Il.	E.G. Nourse	W.I. Myers	J.I. Falconer
16th	1925	New York, NY	M.L. Wilson	A. Leith	J.I. Falconer
17th	1926	St. Louis, Mo.	T.N. Carver	C.L. Holmes	J.I. Falconer
18th	1927	Wash., DC	J.I. Falconer	O.B. Jessness	W.I. Myers
19th	1928	Chicago, Il.	L.C. Gray	M.R. Benedict	W.I. Myers
20th	1929	Wash., DC	H.E. Erdman	I.G. Davis	W.I. Myers
21st	1930	Cleveland, Oh.	H.C.M. Case	L.G. Foster	W.I. Myers
22nd	1931	Wash., DC	O.C. Stine	F.P. Weaver	W.I. Myers
23rd	1932	Cincinnati, Oh.	J.D. Black	V.B. Hart & C. Stewart	Asher Hobson
24th	1933	Philadelphia, Pa.	H.R. Tolley	J.F. Booth & L. Gabbard	Asher Hobson
25th	1934	Chicago, Il.	W.I. Myers	E.C. Young & W. Grimes	Asher Hobson
26th	1935	New York, NY	W.E. Grimes	L. Spencer & W.C. Waite	Asher Hobson
27th	1936	Chicago, Il.	J.S. Davis	H.M. Dixon & A.F. Vass	Asher Hobson
28th	1937	Atlantic City, NJ	O.B. Jessness	N.A. Olsen & T. Schultz	Asher Hobson
29th	1938	Detroit, MI.	E.C. Young	J. Lattimer & H.B. Price	Asher Hobson
30th	1939	Philadelphia, Pa.	I.G. Davis	E. Elliott & F. Waugh	Asher Hobson
31st	1940	New Orleans, La.	H.B. Price	G.A. Pond & H.B. Rowe	Asher Hobson
32nd	1941	New York, NY	M.R. Benedict	S.E. Johnson & L.J. Norton	Asher Hobson
33rd	1942	Cleveland, Oh.	G.S. Wehrwein	R.R. Renne & E.B. Hill	Asher Hobson
Exec.-	1943	Chicago, Il.	S. Johnson	H.R. Wellman & C. Hammar	Asher Hobson
Comm. only (Jan)					
Reg. Mtg. (Sept)	1943	St. Louis, Mo.	S. Johnson	H.R. Wellman & C. Hammar	Asher Hobson
Exec.	1944	Wash., D.C.	Eric Englund	Karl Brandt & G.W. Forster	Asher Hobson
Comm. only (Jan)					
Exec.	1945	Wash., DC	Eric Englund	Karl Brandt & G.W. Forster	Asher Hobson
Comm. only (Feb)					

Meeting	Year	Place	President	Vice Presidents	Secretary-Treasurer
34th (Dec)	1945	Chicago, Il.	L.J. Norton	E.J. Working & D.H. Doane	Asher Hobson
35th (Dec)	1946	Phil., Pa.	F.V. Waugh	W.G. Murray & G.H. Aull	Asher Hobson
36th (Sept)	1947	Gr. Lake, Wi.	Asher Hobson	S.W. Warren & M.C. Clawson	L.J. Norton
37th (Sept)	1948	Gr. Lake, Wi.	W.G. Murray	E.L. Butz & Harold Hedges	L.J. Norton
38th (Aug)	1949	Laramie, Wy.	O.V. Wells	B.W. Allin & T.K. Cowden	L.H. Simerl
39th (Aug)	1950	Montreat, NC	W.C. Waite	J. Ackerman & K.H. Parsons	L.H. Simerl
40th (July)	1951	Guelph, Can.	F.F. Hill	G.S. Shepherd & R. Bressler Jr.	L.H. Simerl
41st (Aug)	1952	Urbana, Il.	G.H. Aull	M.M. Kelso & H.B. James	Don Paarlberg
42nd (Aug)	1953	Corvallis, Or.	H.R. Wellman	D.G. Johnson & T.D. Morse	Don Paarlberg
43rd (Aug)	1954	St. College, Pa.	T.K. Cowden	G.B. Wood & E.O. Heady	Earl L. Butz
44th (July-Aug)	1955	E. Lansing, Mi.	J. Ackerman	W.W. Cochran & J.C. Bottom	L.S. Hardin
45th (Aug)	1956	Asilomar, Ca.	Karl Brandt	L.W. Witt & Karl A. Fox	L.S. Hardin
46th	1957	L. Junaluska, NC	H.B. James	J.F. Timmons & C.P. Hetsig	L.S. Hardin
47th	1958	Winnipeg, Can.	H.C. Trelogan	G.E. Brandow & R.J. Penn	L.S. Hardin
48th	1959	Ithaca, NY	R. Bressler Jr.	A.J. Brown & K.L. Bachman	C.D. Kearl
49th	1960	Ames, Ia.	W.W. Cochran	L.S. Hardin & N.M. Koffsky	C.D. Kearl
50th	1961	Ft. Collins, Co.	W.H. Nicholls	L. Boger & R. Clodius	C.D. Kearl
51st	1962	Storrs, Ct.	B.W. Allin	S. Berg & G.L. Johnson	C.D. Kearl
52nd	1963	Minneapolis, Mn.	G.E. Brandow	D.E. Hathaway & Sidney Hoos	C.D. Kearl
53rd	1964	Lafayette, Ind.	L.S. Hardin	H.F. Breimyer & H.M. Southworth	C.D. Kearl
54th	1965	Stillwater, Ok.	D.G. Johnson	C.E. Bishop & E.N. Castle	C.D. Kearl
55th	1966	College Pk., Md.	K.L. Bachman	Ben C. French & G.S. Tolley	C.D. Kearl
56th	1967	Guelph, Can.	L.W. Witt	K.L. Robinson & R.L. Kohls	C.D. Kearl
57th	1968	Bozeman, Mt.	C.E. Bishop	James Nielson & V.W. Ruttan	C.D. Kearl

Meeting	Year	Place	President	Directors	Secretary-Treasurer
58th	1969	Lexington, Ky.	H.F. Breimyer	J.S. Hillman J.H. Southern D.E. Butz C.R. Wharton J.O. Dunbar W.D. Toussaint	C.D. Kearl
59th	1970	Columbia, Mo.	D.E. Hathaway	D.E. Butz C.R. Wharton J.O. Dunbar W.D. Toussaint R.J. Hildreth L.G. Tweeten	J.C. Redmar
60th	1971	Carbondale, Il.	J.S. Hillman	J.O. Dunbar W.D. Toussaint R.J. Hildreth L.G. Tweeten D.E. McKee W.B. Sundquist	J.C. Redmar
61st	1972	Gainesville, Fl.	V.W. Ruttan	R.J. Hildreth L.G. Tweeten D.E. McKee W.B. Sundquist L.M. Day L.T. Wallace	J.C. Redmar
62nd	1973	Edmonton, Can.	E.N. Castle	D.E. McKee W.B. Sundquist L.M. Day L.T. Wallace	J.C. Redmar

American Agricultural Economics Association

CONSTITUTION

Article I.

NAME

The name of this corporation, hereinafter referred to as the Association, shall be the American Agricultural Economics Association.

Article II.

OBJECTS

The object of the Association is to further the development of systematic knowledge of agricultural economics. As a professional organization, the Association shall pursue this object by facilitating scientific research, instruction, publications, meetings and other activities designed to advance and disseminate knowledge in agricultural economics. The Association shall encourage freedom of economic discussion and shall not commit its members to any position on economic policy issues.

Article III.

DISPOSITION OF FUNDS

Section 1. **Liquidation, dissolution or winding up.** In the event of liquidation, dissolution or winding up of the Association, whether voluntary, involuntary or by operation of law, any disposition made of the assets of the corporation shall be such as is calculated by the executive board exclusively to carry out the educational purposes for which the corporation is formed.

Section 2. **Net Earnings.** No part of the net earnings of the Association may inure to the benefit of members thereof, and the corporation shall be operated as a non-profit organization.

Article IV.

MEMBERSHIP

Section 1. **Qualifications.** Any person having a professional interest in agricultural economics shall be eligible for membership in the Association and may become a member thereof by making proper application to the secretary-treasurer and by paying dues as prescribed.

Section 2. **Classes of members.** The executive board may establish various classes of membership in the Association, each having such rights and privileges as shall be prescribed in the Bylaws. Such classes of membership shall include regular members, junior members and such other classes of membership as shall be established by the executive board.

Section 3. **Joint application and payment of dues.** The executive board may enter into arrangements with other regional and national organizations interested primarily in furthering the development of systematic knowledge of agricultural economics for the purpose of establishing joint applications for membership and joint payment of dues to this Association and such other organization or organizations.

Section 4. **Resignation of members.** Any member may at any time file his or its resignation in writing with the secretary-treasurer of the Association, which resignation shall become effective as of the date received by said secretary-treasurer.

Section 5. **Termination of membership.** The executive board may terminate the membership of any member for nonpayment of dues.

Section 6. **Cessation of property interest.** All right, title and interest, both legal and equitable, of any member in and to the property of the Association shall cease and determine in the event of termination of membership or resignation.

Article V.

EXECUTIVE BOARD

Section 1. **How constituted.** There shall be an executive board of the Association. The board shall consist of the president, president-elect, the most immediate past president available,

and six (6) members who shall be hereinafter referred to as directors, all of whom shall be members in good standing of the Association and who shall be selected as hereinafter provided. The secretary-treasurer, the editor of the official journal of the Association and, upon designation by the executive board, the presidents of any national or regional associations, shall be members ex-officio (non-voting) of the executive board.

Section 2. Selection of members. The president and president-elect shall be selected as hereinafter provided for election to the respective offices. Directors shall be elected by the members of the Association at large. No member of the Association shall be eligible for election as a director after having served one full term as a director. Director positions shall be divided into three classes of two positions each. Except for the initial terms which shall be for a shorter period, the term of the members of each such class shall be for a period of three years or until their successors shall have been chosen and qualify. The terms shall be so arranged that one class of two members is elected each year. Initially, it shall be determined by lot after elections have been held which members shall serve out the respective terms. The term of office for directors shall commence immediately following the annual meeting in the year in which elected. Two candidates shall be nominated for each director position to be filled. The person receiving a plurality of votes for each director position shall be declared elected. A tie vote shall be resolved by chance, conducted under the supervision of the election tellers, and reported to the executive board.

Section 3. Vacancies. If any vacancy shall occur on the executive board for a member serving on such board as an officer of the Association, such vacancy shall be filled as hereinafter provided for filling officer vacancies. For vacancies of director positions existing by reason of resignation, death, inability to serve, election as an officer of the Association or otherwise, the executive board shall appoint a member of the Association in good standing to serve until an election may be held in connection with the next regularly scheduled election at which time the unexpired term, if any, shall be filled by election of the members of the Association. The executive board shall determine when vacancies exist on such board and shall take appropriate action to fill such vacancies as herein provided.

Section 4. Meetings. The executive board shall meet at least once annually with one meeting held in conjunction with the regular annual meeting of the Association. Special meetings shall be called by the secretary-treasurer upon the request of five or more members of the executive board, or may be held at the call of the president of the Association.

Section 5. Power of the executive board. Subject in all respects to the authority and discretion of the general membership of the Association and except as otherwise provided, the executive board shall be the administrative body of the Association and shall have the power and authority to do and perform all acts and functions necessary for operation of the Association.

Section 6. Voting. At any meeting of the executive board, a majority of the members thereof having voting rights shall constitute a quorum. The act of a majority of the executive board present at a duly called meeting at which a quorum is present shall be the act of the executive board. Any action required or permitted to be taken by the executive board at a meeting or by resolution may be taken without a meeting if a consent in writing, setting forth the action so taken, shall be signed by all voting members of the executive board then in office.

Article VI.

OFFICERS

Section 1. Elected. The officers of the Association shall consist of a president, president-elect and the most immediate past president available. The president-elect shall be elected by a vote of the members of the Association having voting rights by mail ballot and shall serve for the year beginning with the adjournment of the annual meeting at which his election is announced and ending with his accession to the presidency at the adjournment of the next annual meeting. In the event of death, incapacity or inability to serve of the president-elect of the preceding year, as determined by the executive board, a president shall be elected for the forthcoming year by vote of the members of the Association having voting power by mail ballot or by vote of the members of the Association at the annual meeting and shall serve for the year beginning with the adjournment of the annual meeting, or, in the case of a mail ballot, following his election and ending with the adjournment of the next annual meeting. After once serving a full term as president-elect no member shall thereafter be eligible to

again serve in that office. The president shall serve for a term of one year commencing with the adjournment of the annual meeting following the period of service as president-elect and ending with the adjournment of the next annual meeting. The persons receiving a plurality of votes for elective offices to be filled shall be declared elected. A tie vote for any office shall be resolved by chance, conducted under the supervision of the election tellers, and reported to the executive board.

Section 2. **Appointed.** The executive board shall appoint a secretary-treasurer and an editor for the official journal of the Association, both of whom shall serve for one-year terms and may succeed themselves in office.

Section 3. **Qualifications.** All nominees for the elective and appointive officer positions and all individuals serving in such positions must be members in good standing of the Association.

Section 4. **Vacancies and succession.** In the event of death, incapacity or inability of the president to serve, as determined by the executive board, the president-elect shall become acting president and shall succeed to the office of president upon completion of the remainder of the term as acting president. If the president-elect is unable to become acting president because of death, incapacity or inability to serve, as determined by the executive board, the executive board shall select from among the directors an acting president who shall serve in that capacity for the unexpired term.

Section 5. **Duties.** The officers of the Association shall perform the duties usually performed by such officers, together with such duties as shall be prescribed by action of the general membership and the executive board. The president of the Association shall preside at all meetings of the general membership and of the executive board. All elective officers of the Association shall serve without compensation. In the event of disability of the president to perform his duties or his absence from any meeting of the general membership or the executive board, the president-elect shall perform the duties of the president during the continuance of such disability or absence. In the event of disability of the president-elect or his absence, the duties of the president shall devolve upon a director to be selected by the executive board until and unless any vacancies may be filled as hereinbefore provided.

Article VII.

NOMINATION TO ELECTIVE OFFICE

Section 1. **Nominating Committee.** The president, with the executive board concurring, shall appoint a nominating committee each year, this committee to consist of the most immediate past president available as chairman and not less than three other members of the Association. The names of the committee members shall be published in the next issue of the official journal of the Association immediately following their appointment, together with an invitation to the general membership that suggestions of nominees for the various elective offices be sent to the chairman of the committee. The nominating committee should take cognizance of the need for geographical, functional and organizational representation on the executive board.

Section 2. **Nominees.** The nominating committee for each year shall be instructed to present to the secretary-treasurer of the Association the names of two nominees for each elective office to be filled including each director position.

Article VIII.

FELLOWS

In recognition of distinguished contributions to agricultural economics, the title "Fellow of the American Agricultural Economics Association" may be conferred upon individuals elected according to procedures specified in the ByLaws.

Article IX.

DUES

Changes in amounts of dues shall be initiated by or through the executive board. Changes in dues for regular members and junior members shall be submitted to the general membership for approval at the annual meeting.

Article X.

ANNUAL MEETING

Section 1. **Scheduling and notice.** There shall be held an annual meeting of the general membership of the Association at a time and place established by the executive board and such other meetings as the executive board may determine. Notice of each meeting shall be mailed to each member at least four weeks in advance of said meeting as directed by the executive board.

Section 2. **Voting and Quorum Requirements.** Fifty members of the Association at any duly called and convened meeting of the Association shall constitute a quorum. Each member of the Association having voting power shall have one vote; voting by proxy shall not be permitted. A majority of the votes cast at any meeting of the Association at which a quorum is present shall be determinative of the issue or resolution except as otherwise specifically provided herein.

Article XI.

COMMITTEES

Section 1. **Creation.** The executive board may provide for the creation of special committees in accordance with the needs of the Association. Standing committees shall be created by vote of the general membership.

Section 2. **Membership.** Members of special and standing committees shall be appointed by the president of the Association.

Article XII.

BYLAWS

Bylaws may be adopted, amended or rescinded by the executive board by a majority vote of the members thereof present at a meeting at which a quorum is present and at which the same is voted on.

Article XIII.

AMENDMENT OF CONSTITUTION

This constitution may be amended by the affirmative vote of two-thirds of the members having voting rights present and voting at any annual business meeting of the Association at which a quorum is present, or by majority vote of members of the Association returning ballots by mail.

Article XIV.

RATIFICATION

This Constitution shall be effective upon ratification either by two-thirds vote of members of the Association present and voting at any annual business meeting of the Association at which a quorum as defined herein is present, or by majority vote of members returning ballots by mail. Ratification of this Constitution shall serve to repeal all prior Constitutions and Bylaws of this Association or predecessor organizations, except as otherwise provided for a transitional period. Upon ratification, this Constitution shall be and become effective commencing January 1, 1968, provided ratification has been accomplished on or before that date and, if not, it shall become effective on January 1 following the date of ratification, and shall be effective prior to such date to the extent needed for purposes of nominations to be made for election to offices of the Association during 1968 or such other year as may be the first full year after ratification. Said ratification shall also constitute approval for the incorporation of the Association as a non-profit corporation and filing of application from exemption from taxation under section 501 of the Internal Revenue Code of 1954 as directed by the executive committee of the predecessor organization.

BYLAWS

of

American Agricultural Economics Association

Article I

Offices

The business office of the Association shall be the business address of the Secretary-Treasurer of the Association. The registered office of the Association shall be the Department of Economics, Iowa State University, Ames, Iowa, and the registered agent at such address shall be Neil E. Harl.

Article II

Membership

Section 1. Application for membership. Any person, firm, corporation, association, group or partnership eligible for membership in one or more classes of members as hereinafter provided may file with the secretary-treasurer of the Association an application for membership in said class or classes of membership. Upon payment of dues as prescribed for the particular membership class, and upon acceptance of the application for membership, the applicant shall be considered a member in good standing of the Association.

Section 2. Classes of members. The membership of the Association shall be comprised of four classes.

a) Regular members shall be entitled to all benefits of Association membership and shall have one vote each at any meeting of the Association.

b) Junior members shall be entitled to all benefits of Association membership and shall have one vote each at any meeting of the Association. Junior membership shall be open to individuals who are actively pursuing study at a college or university and shall be limited to a maximum of three years for each such member. Application for junior membership must be countersigned by the head of the major department in which the applicant is enrolled as a student which countersignature shall attest to current student status.

c) Corresponding members shall have voting rights and shall be entitled to all benefits of Association membership. Foreign agricultural economists who have visited the United States are eligible to become corresponding members upon recommendation of the Agency for International Development.

d) Each sustaining member shall have voting rights, with one vote accorded each such sustaining member, and shall be entitled to such other benefits of Association membership as shall be determined by resolution of the executive board. Any person, firm, corporation, association, group, or partnership may become a sustaining member upon payment of such sum as may be fixed from time to time by resolution of the executive board. Voting rights of sustaining members who are other than individuals may be exercised by the president of such firm, corporation, association, group or partnership, or by his designated representative.

Article III

Association Dues

Section 1. Scale of dues. Each member shall pay Association dues for each year from January 1 to December 31 following, payable on January 1 of each year in advance. The amounts of dues shall be as follows for each class of membership:

- a) Regular membership -- \$15.00
- b) Junior membership -- \$5.00
- c) Corresponding membership -- \$15.00
- c) Sustaining membership -- \$100.00

The above amounts of dues shall include the individual subscription of the member of the official journal of the Association.

Section 2. Default in payment. Membership for any calendar year shall become delinquent as of April 1 of that year if dues are not paid prior to that date.

Article IV

Selection of Fellows

- Section 1. Title. The Title of the award shall be "Fellow of the American Agricultural Economics Association."
- Section 2. Criteria for Selecting Fellows. The main consideration shall be continuous contribution to the advancement of agricultural economics. Achievements may be in the field of research, teaching, extension, administration or business.
- Section 3. Nomination. Any member of the Association may nominate any living person for the honor of election as a Fellow by submitting his name to the Secretary-Treasurer of the Association prior to December 15 preceding the election. Any member making nominations should be prepared upon request to submit biographical information in support of the nominee.
- Section 4. Candidates. The executive board of the Association shall select candidates from the nominees (approximately twice the maximum number to be elected) and present the list of candidates to the fellows election committee of the Association together with supporting biographical data for each.
- Section 5. Election. The fellows election committee shall select the Fellows, not to exceed three in any one year, from the nominees submitted by the executive board of the Association.
- Section 6. Reporting election. The chairman of the fellows election committee shall report to the president and the secretary-treasurer of the Association at least 60 days before the annual meeting the names of the newly elected Fellows.
- Section 7. Announcement of election. The names of the newly elected Fellows shall be announced at the annual meeting of the Association by the president of the Association or his appointed representative, who shall read a statement regarding the achievements of each Fellow and shall present a certificate of recognition to the person so honored. The statement regarding achievements shall be published in the proceedings issue of the official journal of the Association.
- Section 8. Fellows election committee. The fellows election committee shall be a rotating committee with a revolving chairmanship and shall be composed of five Fellows selected as follows:
- a) Each year the president of the Association shall appoint a member from among the Fellows for a five-year term to replace the member whose term expires.
 - b) The president shall also appoint members to fill unexpired terms if vacancies occur during his incumbency and in so doing he shall designate the unexpired portion of the term for which the appointment is made.
 - c) Each year the president shall appoint, from among senior members of the committee in length of time served, the chairman of the committee.
 - d) The president may appoint a secretary for the fellows election committee who need not be a Fellow of the Association or a member of the fellows election committee.

Article V

Awards Program

- To recognize and encourage meritorious contributions to the agricultural economics profession, the Association shall sponsor awards in the following categories. No research shall be eligible for more than one award regardless of the type of award or method of publication.
- Section 1. Outstanding article in journal. This award shall be made by the editorial council and staff of the official journal of the Association. One award may be made each year. An author is limited to one award during each three-year period.
- Section 2. Published research. Recipients for this award shall be selected by the awards committee. Three awards may be made each year. An author is limited

to one award during each three-year period and must be under 41 years of age on date of publication. Entries may be submitted by individuals or organizations. Members of the awards committee are not eligible for the award.

Section 3. Doctoral dissertation. The selection of recipients for this award shall be made by the awards committee. Three awards may be made each year. Entries must be submitted by the head or chairman of the department to which the dissertation was presented and by which it was approved. Each department may submit one dissertation for each eight recipients of the doctoral degree or fraction thereof during the preceding calendar year.

Section 4. Master's thesis. Recipients for this award shall be selected by the awards committee. Three awards may be made each year. Entries must be submitted by the head or chairman of the department to which the thesis was presented and by which it was approved. Each department may submit one thesis for each digit (or fraction thereof) individuals receiving the master's degree during the preceding calendar year.

Section 5. Distinguished undergraduate teacher. The selection of recipients for this award shall be made by the awards committee. Each committee member must have had at least five years of undergraduate teaching experience. One award may be made each year. The award is limited to individuals who have been actively engaged in undergraduate teaching for not less than five years and must have been actively engaged in undergraduate teaching in the year for which the nomination was made. Nominations may be submitted by an individual other than the nominee, by a group of individuals who are colleagues of the nominee, or by a department.

Section 6. Outstanding extension program. Recipients for this award shall be selected by the awards committee. Nominations for the award may be made by any member of the Association. To be eligible for the award, nominees must have shared in primary responsibility for the activity or program which supports the nomination. Two awards may be made each year.

Section 7. Undergraduate debate. Recipients for this award shall be selected by a panel of judges appointed by the appropriate committee. All undergraduate students are eligible to enter competition for this award. Students entering debate competition are also eligible to enter competition for the undergraduate essay award but are not eligible to enter competition for the undergraduate public speaking award.

Section 8. Undergraduate public speaking. Recipients for this award shall be selected by a panel of judges appointed by the appropriate committee. All students are eligible to enter competition for this award. Students entering public speaking competition are also eligible to enter competition for the undergraduate debate award.

Section 9. Undergraduate essay. Recipients for this award shall be selected by a subcommittee of the appropriate committee. All undergraduate students are eligible to enter competition for this award. Students entering undergraduate essay competition are also eligible to enter competition for either the undergraduate debate award or the undergraduate public speaking award. Essays entered in competition for the undergraduate essay award must deal with agricultural economics, agricultural industries, rural sociology. The head or chairman of the department of each entrant must certify the essay as the original work of the student entrant. Entries are limited to a maximum of five for each college or university.

Article VI

Duties of Officers

Section 1. President. The president shall be the chief executive officer of the Association and, subject to the control of the executive board, shall in general supervise and conduct the business and affairs of the Association. He shall, when present, preside at all meetings of the Association and of the executive board. He shall have authority to sign, execute, and acknowledge, on behalf of the Association, those instruments provided in Article VIII hereof and instruments necessary or proper to be executed in the course of the Association's regular business or which shall be authorized by resolution of the executive board. The president shall make appointments to special and standing committees and subcommittees created by action of the executive board or general membership. He shall be responsible for preparing a program for the annual meeting. In general,

the president shall perform all duties incident to the office of president and such other duties as may be prescribed by the executive board from time to time. Section 2. President-elect. In the event of temporary disability of the president to perform his duties or his absence from any meeting of the general membership or of the executive board, the president-elect shall perform the duties of the president during the continuance of such temporary disability or absence as acting president, and when so acting shall have all the powers of and be subject to all the restrictions upon the president. The president-elect shall perform such other duties and have such authority as from time to time may be assigned to him by the president or the executive board.

In the event of death, incapacity or inability to serve of the president-elect, as provided in Article VI, Section 1 of the Constitution, the executive board shall determine, giving due consideration to exigencies of time, whether the selection of a president shall be by vote of members of the Association having voting power by mail ballot or by vote of the members of the Association at the annual meeting.

Section 3. Secretary-Treasurer. The Secretary-Treasurer shall (a) keep the minutes of the meetings of the general membership of the Association and of the executive board in one or more books provided for that purpose; (b) see that all notices are duly given in accordance with the provisions of these Bylaws, the Constitution, Articles of Incorporation, or as required by law; (c) be custodian of the Association's records; (d) maintain the register of the post office address of members of each class; (e) certify resolutions; (f) have charge and custody and be responsible for all funds and securities of the Association, receive and give receipts for moneys due and payable to the Association from any source whatsoever, endorse and deposit all such monies in the name of the Association in such banks, trust companies or other depositories as shall be designated by resolution of the executive board; (g) function as principal accounting officer in charge of books of account, accounting records, and forms of the Association; (h) maintain adequate records of all assets, liabilities, and transactions of the Association; (i) obtain from other officers all reports needed for recording the general operation of the Association or for supervising and directing accounts; and (j) in general perform all of the duties incident to the office of secretary-treasurer and have such other duties and exercise such other authority as from time to time may be delegated or assigned to him by the president or the executive board. The secretary-treasurer shall be covered by a fidelity bond in an amount determined by resolution of the executive board.

Article VII

Elections

Section 1. Ballots. Not later than May 1 of each year, the secretary-treasurer shall mail a ballot to each member of the Association having voting rights as of April 1. Said ballot shall provide for an opportunity to vote for each nominee for each elective office to be filled. The nominees for each director position shall be listed and voted upon independently from other positions on the executive board. For each elective office, the ballot shall contain one blank line for write-in candidates. A brief biographical sketch of each nominee selected by the nominating committee shall be included. The ballot shall be enclosed in an envelope which shall be marked on the outside thereof as follows:

"Ballot of Officers and Directors of the American Agricultural Economics Association. This ballot must reach the secretary-treasurer not later than June 15 to be counted. Name _____"

Your name is required for checking with the list of members whose dues have been paid as of April 1, which constitutes eligibility to vote.

Section 2. Tellers. The sealed ballots shall be opened by tellers appointed by the president. The results shall be reported to the executive board not later than July 1 and appropriately thereafter to the membership. The persons receiving a plurality of votes shall be declared elected. A tie for any office shall be resolved by chance, conducted under the supervision of the tellers and reported to the executive board."

Article VIII

Commercial Transactions

Section 1. Endorsement of stock certificates. Any share or shares of stock issued by any corporation and owned by this Association may, for sale or transfer, be endorsed in the name of the Association by the president or the secretary-treasurer, subject to specific directions as to such sale or transfer by the executive board.

Section 2. Voting of shares. Any share or shares of stock issued by any corporation and owned by this Association may be voted at any shareholders' meeting of such corporation in person or by proxy by the president or the secretary-treasurer.

Section 3. Deposits. All funds of the Association not otherwise employed shall be deposited from time to time to the credit of the Association in such banks, trust companies, or other depositories as may be determined by resolution of the executive board.

Section 4. Execution of deeds, mortgages and releases. All deeds conveyances, leases and mortgages of real property made by the Association shall be executed by the president, and all releases of mortgages, liens, judgments, and other claims that are required by law to be made a matter of record may be executed by the president or secretary-treasurer of the Association.

Section 5. Negotiable instruments. All checks, drafts, notes, bonds, bills of exchange, and orders for the payment of money of the Association must be signed by either the president or the secretary-treasurer.

Section 6. Borrowing money. The secretary-treasurer may borrow money up to a maximum total amount of ten thousand dollars without further executive board authorization and may pledge as security therefore stocks and securities of the Association as required.

Section 7. Purchase and sale contracts. The president shall have the authority to enter into written or oral contracts for the purchase and sale of goods and services on behalf of the Association. The secretary-treasurer may enter into written or oral contracts for the purchase of supplies, postage, printing services, and other goods and services reasonably related to operation of the office of secretary-treasurer.

Article IX

Fiscal Year

The fiscal year of the Association shall begin on the first day of January and end on the thirty-first day of December in each year.

Article X

Procedures for Meetings

Section 1. Resolutions. All resolutions pertaining to policy matters presented from the floor at meetings of the Association for approval must be submitted at least one full day in advance to the executive board. The executive board shall report all such proposed resolutions and resolutions initiated by the executive board and the president to the general membership for action with appropriate recommendation for or against passage.

Section 2. Appropriations. All motions presented from the floor at meetings of the Association entailing, directly or indirectly, appropriation of monies of the Association, must be submitted at least two full days in advance to the executive board. The executive board shall report all such proposed motions to the general membership for action with appropriate recommendations for or against passage.

Section 3. Parliamentary authority. The rules contained in Roberts' Rules of Order Revised shall govern meetings of this Association in all cases in which

they are applicable and in which they are not inconsistent with these Bylaws, the Constitution, the Articles of Incorporation, or applicable law.

Article XI

Appropriations and Expenses

Section 1. Annual budget. The executive board shall approve the annual budget for the Association, which approval shall constitute authorization for expenditure.

Article XII

Committees

Section 1. Standing Committees. There shall be standing committees on

- Audit
- Awards
- Membership and Sustaining Membership
- Fellows Election
- Investment
- Economic Statistics
- Editorial Council
- Professional Activities
- Tellers
- Student Affairs

Each standing committee may recommend to the executive board the creation of specific subcommittees.

Section 2. Special committees. There shall be such special committees as the executive board shall from time to time create by resolution.

Section 3. Ad hoc committees. The president may from time to time create ad hoc committees whose existence shall terminate with the expiration of the president's term of office.

Section 4. Travel expenses for committee activities. Committees may incur travel expenses in connection with their assignments only as specifically authorized by action of the Executive Board except that the President may at his discretion authorize travel expenses for an individual member in clearly unusual circumstances.

Article XIII

Student Section

Section 1. Authority for Student Section. There is hereby created an organization within the Association to be known as the Student Section - American Agricultural Economics Association (hereinafter referred to as the SS-AAEA). The SS-AAEA shall function pursuant to a constitution which shall be developed initially by the SS-AAEA or a committee thereof, approved by a two-thirds vote of the SS-AAEA members present and voting at a meeting of the SS-AAEA at which a quorum is present, and then submitted to the Executive Board of the Association for approval. For purposes of this section, representation from at least twenty percent (20%) of the chartered chapters shall constitute a quorum. Amendments to the constitution of the SS-AAEA shall likewise be submitted to a vote of the members of the SS-AAEA under the voting and quorum rules hereinbefore specified and then submitted to the Executive Board of the Association for approval. The constitution of the SS-AAEA may provide for a statement of purposes, membership rules consistent with the Bylaws of the Association, selection of officers, election of a governing board of not more than seven (7) members in addition to the officers, duties of officers and the governing board, and provisions for meetings, voting (including apportionment of voting rights on the basis of chartered chapters for all matters except for approval of the initial constitution of the SS-AAEA or any amendments thereto which shall require a vote of the members as herein provided) and standing committees. The governing

board of the SS-AAEA may develop bylaws containing internal governing rules for the SS-AAEA, which bylaws shall be submitted to the Student Affairs Committee of the Association for approval after the bylaws or amendments thereto have been approved by majority vote of the governing board.

Section 2. Chartering of local chapters. Any Department of Agricultural Economics, Department of Economics having programs of undergraduate study in agricultural economics or agricultural business or any college or university or division thereof having programs of undergraduate study in agricultural economics or agricultural business, may make application to the Student Affairs Committee of the Association for the creation of a chapter of the SS-AAEA. Upon making such application, fulfilling requirements imposed by the Student Affairs Committee and paying a charter fee of five dollars (\$5), such chapter shall be created by issuance of a charter by the Student Affairs Committee, signed by the chairman of such Committee, the president of the Association, a director of the Association appointed by the president of the Association as a liaison member of the Student Affairs Committee, and the president of the SS-AAEA. Charters shall be issued initially for a term of five years and may be renewed for successive terms of five years each upon filing an application for renewal and payment of a renewal fee of five dollars (\$5) for each such renewal. For chapters chartered prior to January 1, 1965, such charters shall be deemed to expire on January 1, 1970, unless application for renewal is filed and renewal fee is paid prior to said date. Payments for original and renewal charter fees shall be made payable to the treasurer of the SS-AAEA and shall be transmitted to the chairman of the Student Affairs Committee who shall, upon approval and issuance of the charter, forward such payments to the treasurer of the SS-AAEA.

Section 3. Membership. Any undergraduate student majoring or minoring in agricultural economics, agricultural business or other curricula within or administered by a Department of Economics or Agricultural Economics in a college or university, or any member of a locally chartered chapter as hereinbefore provided, may become a member of the SS-AAEA. Members of a duly chartered local chapter shall be deemed automatically to be members of the SS-AAEA by virtue of membership in the local chapter. Membership certificates may be purchased by local chapter organizations from the SS-AAEA. An individual who is otherwise qualified for membership but who is not a member of a chartered chapter may become a member of the SS-AAEA by filing application with the treasurer of the SS-AAEA. Membership certificates shall bear the seal of the Association which shall be applied by the chairman of the Student Affairs Committee or his designated representative. Membership in the SS-AAEA shall not be considered a condition precedent to participation in events of the SS-AAEA, nor shall such membership be considered an eligibility requirement for awards given by the Association.

Section 4. Accountability of funds. All charter fees and other funds generated by the SS-AAEA shall be made payable to the treasurer of the SS-AAEA and transmitted to the treasurer of the SS-AAEA for recordation and consolidation, and then forwarded to the treasurer of the Association for credit on the books of account of the Association in such account or accounts in the name of the SS-AAEA as shall be deemed advisable by the treasurer of the Association. The treasurer of the SS-AAEA shall be bonded to an amount of at least two thousand dollars (\$2,000) by a general fiduciary bond. All payments from funds of the SS-AAEA shall be by check drawn by the treasurer of the Association as drawer upon request by the treasurer of the SS-AAEA which request shall be countersigned by the chairman of the Student Affairs Committee of the Association or his designated representative. The SS-AAEA shall prepare a budget each year with the budget submitted to the Student Affairs Committee for approval prior to the beginning of the accounting period involved.

Section 5. Role and duties of the Student Affairs Committee. The Student Affairs Committee of the Association shall be responsible for working with and coordinating activities of the SS-AAEA as an integral part of the Association as a professional organization; organizing and conducting suitable and appropriate procedures or contests leading to the selection of recipients for undergraduate debate, undergraduate public speaking and undergraduate essay awards, working with the Awards Committee in presenting such awards; encouraging, supervising and approving the chartering of local chapters of the SS-AAEA;

approving bylaws of the governing body of the SS-AAEA and all amendments thereto; approving expenditures from SS-AAEA funds; assisting the officers and governing board of the SS-AAEA in preparation of an annual budget; approving the annual budget of the SS-AAEA; providing advice and counsel to the officers, governing board and committees of the SS-AAEA; communicating with and making recommendations to the Executive Board of the Association regarding the affairs and programs of the SS-AAEA; assisting in program planning for SS-AAEA meetings; facilitating the organization and conduct of regional and national meetings in furtherance of the purposes of the SS-AAEA; and such other duties as the Executive Board of the Association may assign.

Article XIV

Amendments

These Bylaws may be amended by a majority vote of the members of the executive board present at a meeting at which a quorum is present and at which the same is voted on.

As amended August 17, 1969.

OBJECTIVES OF THE AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION

As stated in its constitution, the objective of this Association is to further the development of systematic knowledge of agricultural economics for the purpose of improving agriculture and agriculture's contribution to the general economy. As a professional organization, the Association will pursue this objective by facilitating scientific research, instruction, publications, meetings, and other activities designed to advance and disseminate knowledge in agricultural economics.

IN MORE SPECIFIC TERMS, THE AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION EXISTS:

- To encourage effective investigation and free discussion of the various topics and issues in agricultural economics.
- To promote and maintain high standards of accomplishment in research, teaching, and extension in agricultural economics by fostering study, writing, and contacts which contribute to this end.
- To stimulate objective analysis and discussion of existing and proposed economic policies and programs affecting the welfare of farmers or affecting the general public as consumers of food and fiber.
- To provide a means of publication (American Journal of Agricultural Economics) for scholarly analyses and research findings in the field, and other items of general interest to the membership.
- To promote interest in and understanding of the profession of agricultural economics among college students.
- To provide a medium for effective professional cooperation among agricultural economists and scientists in other fields.
- To solicit the interest and support of farmers, consumers, and other economic groups in the study and analysis of the economic problems of agriculture.

THE PRINCIPAL ACTIVITIES OF THE ASSOCIATION INCLUDE:

- Publication of the American Journal of Agricultural Economics (February, May, August, November and special Proceedings Issue in December).
- Planning and conducting meetings of the membership (annual meeting in August and winter meeting in December).
- Participation in meetings of allied professional groups (joint meetings in December).
- Sponsorship of annual awards for research, teaching and extension activities.
- Periodic production of biographical directory of the Association's membership.
- Recognition of outstanding agricultural economists through an honorary Fellows program.

The Association is a non-profit organization devoted to the advancement of the profession. The above activities are, therefore, financed by the membership through payment of the dues, by subscriptions and by the sustaining membership support of businesses. Membership is open to those having a professional interest in agricultural economics.

Applications for membership, payment of dues and subscriptions, changes in address, or inquiries regarding the general affairs of the association should be addressed to John C. Redman, Secretary-Treasurer, American Agricultural Economics Association, Department of Agricultural Economics, University of Kentucky, Lexington, Kentucky 40506.

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journal of agricultural economics

*AAEA Annual Meeting
University of Alberta
Edmonton, Alberta, Canada
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1972 PROCEEDINGS ISSUE

- CASTLE · Economics and the Quality of Life
NICHOLLS · Southern Tradition and Regional Progress
HEADLEY · Agricultural Productivity and Environmental
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HILDRETH AND SCHALLER · Community Development in the
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EDITORIAL POLICY

It is the basic objective of the JOURNAL to promote creative and scholarly work in agricultural economics. Since there is no universally accepted definition of agricultural economics, the editors do not have a prestructured view of the JOURNAL's content. Manuscripts, however, which have no apparent relationship to the economics of agriculture, natural resources, and/or rural and community development will generally be excluded from consideration. The editors encourage submission of papers in the extension, teaching, and business phases of agricultural economics, as well as research manuscripts.

EDITORIAL COMMUNICATIONS

All manuscripts and editorial correspondence, except that concerning *Books Received and Reviewed*, should be addressed to the Editor, Leo Polopolus, Department of Food and Resource Economics, University of Florida, Gainesville, Florida 32601.

Communications concerning books for review and books submitted for announcement in the JOURNAL should be sent to Peter G. Helmberger, Department of Agricultural Economics, University of Wisconsin, Madison, Wisconsin 53706.

SUBSCRIPTIONS

Members of the American Agricultural Economics Association receive the JOURNAL as part of their membership. Yearly subscriptions, \$25; individual issues, \$5.

Correspondence regarding subscriptions, orders for individual copies of the JOURNAL and changes of address should be sent to John C. Redman, Department of Agricultural Economics, University of Kentucky, Lexington, Kentucky 40506.

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KARL A. FOX



1972 AAEA FELLOW

KARL A. FOX

*Distinguished Professor, Iowa State University
Fellow, Econometric Society, American Statistical
Association, and the American Association
for the Advancement of Science*

*Former Head, Department of Economics, Iowa
State University*

*Staff Economist, Council of Economic Advisors,
1954-1955*

*Former Head, Division of Statistical and Historical
Research, U. S. Bureau of Agricultural
Economics*

KARL A. FOX is internationally recognized for his work in econometrics. His early research made major contributions in statistical demand analysis, the appraisal of farm price and income policies, and the analysis of interregional transportation and price patterns for farm products. Later, he extended his interests in econometric methods to quantitative economic policy generally, to regional and urban economics, and to optimization models for educational planning. But far beyond his great contributions in quantifying economic relationships has been his deep commitment to mankind as the true concern of the social sciences. Always responsive to new challenges, he has used his technical expertise and his ability to conceptualize social and economic problems that transcend narrow disciplinary boundaries to contribute to knowledge in a wide variety of fields.

Dr. Fox was born in 1917 in Salt Lake City. He received bachelor's and master's degrees from the University of Utah and the Ph.D. in 1954 from the University of California.

In 1968 Dr. Fox was named Distinguished

Professor in Sciences and Humanities by Iowa State University, where he headed the Department of Economics from 1955 to 1972. Under his guidance the Department's traditional leading role in agricultural economics grew to include graduate training and research in economics generally. He was staff economist, Council of Economic Advisors, from 1954 to 1955; prior to that he was associate head, 1947-1951, and then head, 1951-1954, of the Division of Statistical and Historical Research of the U. S. Bureau of Agricultural Economics.

His achievements have brought him many honors. He is a fellow of the Econometric Society, the American Statistical Association, and the American Association for the Advancement of Science. He has served on the Board of Directors of the Social Science Research Council and as a member of the Universities-National Bureau Committee for Economic Research.

He served the American Farm Economic Association as vice president in 1955-1956 and as a member of the Editorial Council of the *Journal* during 1954-1957. He received Association

awards for outstanding published research in 1952, 1954, and 1957, and for his doctoral dissertation in 1953. These awards and subsequent writings established his eminence as a writer. He has authored or coauthored a number of books including *Intermediate Economic Statis-*

tics, *The Theory of Quantitative Economic Policy*, and *Economic Analysis and Operations Research*. He is also the author of more than a hundred articles, and among the several volumes he has edited or coedited is the well-known *Readings in the Economics of Agriculture*.



PRESIDENT
AMERICAN AGRICULTURAL
ECONOMICS ASSOCIATION
1972-1973

EMERY N. CASTLE

Dean of the Graduate School, Oregon State University

Former Head, Department of Agricultural Economics, Oregon State University

Former Director, Water Resources Research Institute, Oregon State University

1970 Alumni Distinguished Professor Award, Oregon State University

Former Chairman, Western Agricultural Economics Research Council

EMERY N. CASTLE is dean of the graduate school and professor of agricultural economics at Oregon State University, where he has been since 1954. At Oregon State he has served as dean of faculty, head of the Department of Agricultural Economics, director of the Water Resources Research Institute, and as a member of a three-person Presidential Commission on University Goals. In 1970 he was awarded the Oregon State University Alumni Distinguished Professor Award.

He has been visiting professor at Purdue University and on the faculties of Kansas State and Iowa State Universities and the University of Kansas. From 1952 to 1954 he was an economist at the Federal Reserve Bank of Kansas City.

Dr. Castle's professional work as an agricultural economist at Oregon State has included teaching at both the graduate and undergraduate levels, research, and extension work. His writings include journal articles, experiment station publications, a textbook, and numerous contributions to other professional works. He has

written primarily in the fields of resource economics, research methodology, agricultural policy, production economics, and education policy.

After completing bachelor's and master's degrees at Kansas State University, Dr. Castle obtained his doctorate from Iowa State University. He did postgraduate work at North Carolina State University.

Dr. Castle has been a vice president of the American Farm Economic Association and president, vice president, and editor of the Western Farm Economics Association. He served three years as chairman of the AAEE Awards Committee. He has been a member and vice chairman of the Executive Board of the Universities Council on Water Resources, as well as member and chairman of the Western Agricultural Economics Research Council. He served eight years as a member of the State Water Resources Board of Oregon and has been a consultant to the Departments of Agriculture and Interior and the National Water Commission.

PRESIDENTIAL ADDRESS

Economics and the Quality of Life*

EMERY N. CASTLE

QUANTITY OF LIFE" has become a cliché; environmental quality is of concern to many who have little previous interest in anything even remotely related to such a subject. Economic growth and improved quality of life are generally believed to be highly competitive. Why, then, has quality of life surfaced at a time when we are also worried about

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In preparing for this address, numerous presidential addresses given to this Association and to the American Economics Association were read. Generally speaking, "addresses" can be classified as positive, those that attempt to advance our thinking with respect to some part of economics or agricultural economics; or normative, those that exhort the profession to mend its ways. The policy advice tends to fluctuate between those who argue new areas should be opened and those who believe we have lost sight of the fundamentals. In this respect there is no great difference between the associations.

One difference that does emerge is the matter of humor. Generally speaking, agricultural economists are a somber bunch. The economists, on the other hand, are not universally so and seem to take themselves less seriously. This author does not break with the tradition, but it is hoped some future president will provide a more lighthearted touch.

This address is in the positive tradition. I have never been impressed by those who advise with great confidence with respect to what "ought to be" but who cannot explain "what is." Nevertheless, some normative statements have been included. In part, this is because I have some confidence in the principles set forth; in part, it is because time is short, and suggestions regarding what "ought to be" may stimulate needed discussion on the quality of life at a time when our society appears to be on the verge of decision with respect to many of the issues discussed.

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economic performance? Few would deny that a relationship exists between the two sets of issues. Yet, if we probe deeply, there is not agreement as to what this relationship is or even agreement as to the meaning of different possible relationships. This lack of agreement exists not only between and within the various social sciences but within the populace as well. Questions important for public policy as well as for the economics profession are involved in this set of issues. For example,

1. To what extent is the current concern for quality of life and environmental quality a function of an affluent society? Is quality of life of concern mainly to those who have sufficient income to permit them to become satiated with that which the market system is producing?
2. What is the role of economics and the economist in public policy related to quality? Will social scientists, other than economists, achieve great importance in public policy at the expense of economists, or is there an unexploited complementarity?
3. Do the current concerns with quality of life and environmental quality have, at least in part, an economic base? If so, is this a common base, or are they distinct economic issues?

One may grant the interesting nature of these questions but still doubt whether they are of central concern to agricultural economists. If they are not, it would be inappropriate to discuss them on this occasion, but if the analysis on which this paper rests is even partially correct, quality problems are, in fact, crucial to much of contemporary agricultural economics. In the course of this paper the relation of quality to marketing, to rural development, and to resource economics will be treated. Undoubtedly there are other applications to agricultural economics which have been overlooked.

In this paper an attempt is made both to create and apply a framework for analyzing the economics of quality. Quality of life issues have arisen because of a complex and interdependent society; the framework for analysis is inevitably

complex and abstract. Furthermore, the scope of possible application is indeed extensive because both private and public choice issues are involved. This immediately raises the very practical question of communication. The procedure that has been decided upon is to confine all highly technical material to footnotes and the Appendix. Thus, those who wish to penetrate more deeply into the subject and who wish to test my framework and my reasoning on the fundamental issues will have the opportunity to do so when the published version becomes available. For those who are listening, I propose to serve as your guide on an imaginary journey through the subject of quality. On our tour there will be stops at:

1. The Economics of Quality.
2. The Private and Public Dimensions of Quality.

While we are at this stop, we will explore together

- a. Quality in the Market Place,
- b. Quality and Public Choice,
- c. Quality of Life and Multidisciplinary Requirements,
- d. Quality and Resource Economics,
- e. Quality and Rural Development.

Our third stop will be at a place called:

3. The Quality of Life and Economic Affluence.

The final stop on the journey will be at a place I have chosen to name:

4. The Quality of Economics.

The journey has been arranged to permit one to benefit by being present for only part of the tour. Even so, the full appreciation of the land to be visited will come only by complete participation throughout the journey and by additional reading, thought, and discussion. All aboard! The first stop will be:

The Economics of Quality

There is a tradition in economics which assigns the term "qualitative" to that for which the term "quantitative" is inappropriate. Ordinal, contrasted to cardinal, measurement is suggested, and policy recommendations tend to emphasize directional statements. Mathematical formulations of economic relations are possible, but the system will emphasize the use of inequalities [21, 22].

While such an approach is appropriate for some purposes, a different point of view is nec-

essary for the purposes at hand. As used here, qualitative is not necessarily non-quantitative or non-quantifiable.¹ The essence of the concept, as used here, is that heterogeneity is necessary to the existence of quality. If homogeneity prevails, no standard of comparison exists, and qualitative comparisons are not possible.²

How, then, are homogeneity and heterogeneity to be defined in an economic context? Most goods have multiple attributes and supply more than one need in production or consumption [19, 20]. An apple may be desired because it is nutritious, because of its flavor, and because of its appearance. Appearance, in turn, may be dependent upon size, color, and shape. The quantity of a good may be measured by one attribute, or by some combination of attributes. Goods may be said to be homogeneous, from an economic point of view, when the attribute for which the price is quoted is the only attribute of economic significance, or when all other attributes vary proportionally with the one which is chosen for price quotation. Thus, apples may be sold by number if the correlation of relevant attributes is very high or perfect, as one unit of the good is compared with another.

Heterogeneity and greater complexity arise when attributes are not perfectly correlated. Heterogeneous goods may be subdivided into two general classes. One class includes those goods whose attributes can be predicted. Thus, imperfectly correlated but known relationships among attributes will give rise to what Geor-

¹ "Whatever the consensus of philosophers might be, it is *not* that 'quality' is diametrically opposed to 'quantity' " [28, p. 20].

² S. V. Ciriacy-Wantrup was an early contributor to the economics of quality [9, 10, 11]. In his review of an earlier version of this paper, Professor Wantrup said, "Using your terminology, the term 'homogenous' can be substituted for 'one-dimensional,' and 'heterogenous' for 'multi-dimensional.' Care must be taken, however, to keep in mind that the differentiation between quality and quantity is a consequence of the way reality is described, defined, and evaluated. This difference is not an inherent attribute of reality."

In an unpublished portion of his Ph.D. thesis, Joe B. Stevens [28] has a brief discussion and literature review of the concept of quality and its economic meaning. In 1939, A. T. Court [12] wrote an essay on price indexes for automobiles, with particular emphasis on quality changes. More than two decades later, Zvi Griliches published his imaginative work on the measurement of qualitative changes over time [17, 18]. Griliches proposed that the quality of a commodity be regarded as a number of different characteristics, each of which might be objectively measured or ranked. The Griliches concept of quality is consistent with that used in this paper.

gescu-Roegen refers to as "quantified quality."³

The other set of heterogeneous goods includes those for which the relationship among the attributes cannot be predicted or controlled. In such circumstances there may not be confidence that any one attribute is a proxy for value. There will be two general responses to this state of affairs. One is for each unit to carry a unique price. When this happens, the scope of the market will be severely limited; each combination of attributes will be considered separately. The other general reaction, when the combination of attributes cannot be predicted or controlled, is for price to be quoted for one attribute, or for a unit of the good, and the level of the other attributes to be specified. Grades and standards are means of attribute specification and can be established if a sufficient number of units can be produced to make the grade or standard meaningful.

The economics of quality, then, will be concerned with multiple attributes of a good, product, or commodity.⁴ The existence of jointness of these multiple attributes in production or consumption and an inability to control their combination give rise to issues of quality. Thus, over time, if we sacrifice the flavor of apples in favor of uniformity of size or keeping ability but continue to quote price in pounds, it is appropriate to raise questions about quality

change over time and whether relative prices over time accurately reflect relative scarcities.

The Private and Public Dimensions of Quality

In any serious discussion of the quality of life, both the private and public sectors of the economy must be considered. The investigations of Ralph Nader and the rise of consumerism are testimony to the concern which exists with respect to the performance of private enterprise. Yet, there is a parallel concern about the performance of the public sector. It is necessary that we visit both on this second stop of our journey. We go first to the private sector.

Quality in the market place

There has been much discussion in recent years to the effect that our enterprise system has imposed a depressing uniformity and standardization on the consuming public. The development of identical tract houses side by side, the sameness of apartment dwellings, mass-produced automobiles and clothing are cited as examples. Yet, one of the chapter headings in *Future Shock* is entitled "The Origins of Overchoice." Toffler believes that the notion of a lack of choice is based on factual ignorance of what he calls "the nature, the meaning, and the direction of the Super-Industrial Revolution" [31, p. 264]. The economics of quality gives insight into this apparent contradiction, as well as to what is frequently labeled non-price competition.

There are two main avenues of achieving standardization of goods. One is outright control, that is, to embark on a production process that makes attributes independent rather than joint in production. In the case of biological phenomena, advances in plant and animal breeding may make possible greater uniformity in certain attributes by genetic management. With physical phenomena, there may be separate production processes prior to synthesis of the final product. Thus, for automobiles body styles, size of motor, color of body, and other attributes are each programmed separately and then combined to permit substantial consumer choice. The other general approach is by the production of large numbers and subsequent standardization through grades and classes. Variation in production is permitted, but subsequent classification becomes possible if sufficient volume is produced, relative to the number of grades or classes which are established. Thus, greater choice is per-

³ He writes, "... If the variables immediately connected by a phenomenon are cardinally measurable, then they can all be increased in the same proportion and still represent the same phenomenon. The formula describing the phenomenon then must be homogeneous and linear, or more generally, a homogeneous function of the first degree. On the other hand, if some variable is a quantified quality, nothing seems to cast doubt over our expectations that the formula will be non-linear" [16, p. 54]. Thus, "... non-linearity is the aspect under which the qualitative residual appears in a numerical formula of a quality-related phenomenon" [16, p. 53].

⁴ Edwards finds it useful to say that firms produce products and that consumers consume commodities [13]. Homogeneous products and commodities are defined as having constant marginal rates of substitution in production and consumption. The distinction between products and commodities permits the influence of production and consumption functions to be kept separate. Edwards has shown that Chamberlin [7] neglected utility analysis and demonstrates that it is possible to treat heterogeneous products in a more general fashion than did Chamberlin. He has also demonstrated that much of the debate between the neoclassical theory of value group and those who rely on market structure theory can be explained by a systematic treatment of both production and consumption theory—thus, the need for the distinction between products and commodities.

mitted by creating numerous groups of homogeneous goods and by then offering the consumer choice among the groups. Whether "control" or "large numbers" will be the more efficient approach at a point in time will depend on the state of the arts and the size of the market.

The "control" case is more interesting because an enterprise system will tend to move in this direction over time. The technology which will permit control, standardization, and homogeneity will obviously have economic value. Such technology will tend to be developed in response to the economic incentive. First, the production condition for the separation of attributes and homogeneity must be achieved. Then, a recombination of attributes is brought about, based on the desires of the consumer. In this way, the "overchoice" described in *Future Shock* may be rationalized in terms of the economics of quality.

Advances in biological control will continue to result in greater separability of the attributes of economic significance for agricultural products. As this happens, there will be a greater variety of food products on the market; "quality of product" will be less of an issue, and agricultural and industrial production and marketing will be less distinguishable. In a shorter-run context, there may be such an economic advantage to the production of standardized products that they will drive from the market those products that have greater variation in some of their attributes. Under these circumstances it is possible that a welfare loss may occur, although it is difficult to measure welfare changes over time [17, 18]. Nevertheless, it is hypothesized that increased choice over time will result if the cost of uncontrolled heterogeneity is internalized.⁵

The economics of quality also provides some insight into what is frequently called non-price competition. Machlup [23] states that selling

effort and quality improvement are the two main elements of competition other than price competition.⁶ If a commodity has two attributes of economic significance, either of which can be measured, there are several alternative ways in which the pricing can occur. One or the other of the attributes may be chosen as a basis for price quotation. Yet, if the attribute not chosen has economic significance, it is obvious competition will occur with respect to the neglected attribute.

Competition may be manifested in numerous ways with respect to the attribute not chosen. If the sale is by contract, this competition may be in the nature of product specifications. Specifications become a technique for defining a product; they are an extension of quantification and are a way of creating homogeneity. What may appear to be "non-price" competition may, in some instances, simply be a way of substituting increments of one attribute for increments of another in the production or consumption of a product or commodity. Market prices and/or costs may be very central to these decisions; of course, the textbook conditions used to illustrate price competition will not prevail, and multiple rather than a single dimension of product or commodity may need to be incorporated into the analysis. An increasingly sophisticated marketing system will find improved means of product identification and definition. The more rigorously a product or commodity is defined, the more routine production and marketing processes can become.

Quality and public choice⁷

In our journey to this point we have visited only the most primitive manifestations of quality. The economics of quality has been defined and illustrated in traditional, private sector, micro terms. Yet, "quality of life" is a general policy issue, and to have meaning in terms of

⁵ A product or a commodity may be viewed differently, depending on whether the demand is derived or final. Thus, an attribute of a commodity that makes it desirable to someone in the marketing chain may not be viewed in the same way by the ultimate consumer. If consumer sovereignty reigns, intuition suggests that the derived demand attributes would be a reflection of consumer desires. It is possible the issue has been analyzed in marketing literature which I have not read. If not, the correlation of desirable commodity attributes at different points in the marketing chain may yield insights as to the adequacy of performance of the private sector.

⁶ Machlup denies that quality is measurable, but it is obvious that he has in mind the measurability in economic terms of a combination of attributes. This, of course, is the central issue with respect to the economics of quality and is a very different problem than the quantification of a particular attribute.

⁷ Collective and public goods have been used in this paper as synonymous with goods produced by the public sector. This is a different definition than is in common usage in welfare economics literature. In this literature, collective or public goods refers to those goods where the quantity consumed by one consumer does not affect the quantity consumed by others [24]. For an elaboration, see Olson [26].

contemporary dialogue, the economics of quality must come to grips with policy problems. Further, if the definition that has been advanced is valid, it should be possible to demonstrate that it is applicable to both the public and private sectors.

Failure to account for the interdependence between market and nonmarket phenomena is at the heart of our concern with the quality of life.⁸ One might over-simplify the issue by saying that our welfare is a function of everything that enters Gross National Product, plus some "other things" as well. So long as it can be assumed that the "other things" vary directly with GNP, GNP will serve as a proxy for welfare. However, there is no *a priori* reason for expecting this to occur, and such empirical evidence as is available leads one to suspect that such an assumption would not be consistent with reality.

Assume there are numerous components that enter the social welfare function and that these can be identified. Assume further that both the private and public sectors contribute to the production of these components. These may be classified into such items as, say, (1) education, (2) physical health, (3) social and political participation, (4) housing, and (5) environmental quality. These components of welfare can be viewed as being parallel to the attributes of the commodities described earlier; if they are independent but competitive in production and consumption, they can be evaluated and the appropriate level of production can be judged by balancing aggregate satisfaction against the opportunity cost of some other welfare component whose production will need to be reduced. Thus, the analogy is that the attributes of a commodity enter the utility function of the consumer and that the components of welfare, as defined here, enter the social welfare function of a society. These components have become known as social objectives; this is why there is much current discussion of multiple objective analysis.

An exact parallel or analogy between the private and public sectors may not exist for all circumstances. The reason involves the difficulty of defining products or commodities for

the public sector so that they are exact analogs of these terms as they are applied to the private sector. We must also recognize that all units of a component, as the term has been used here, may not be homogeneous. Even though this complicates, it does not invalidate the analysis suggested here.

The traditional analytical base for evaluating the production of public sector goods has been benefit-cost analysis. Benefit-cost analysis, however, assumes that national income is to be maximized and does not permit the consideration of multiple objectives. When multiple objectives exist, a complete conceptual solution is possible only if a social welfare function can be identified. Conceptual tidiness, of course, often has to be sacrificed in the world of practical affairs. The standard prescription in today's world has been to use operations research techniques to discover "trade-off" among objectives. Decision makers, within the institutional framework, are then relied upon to choose that combination of welfare components which, in their judgment and in light of the political realities, is most appropriate. The role of the analyst is to discover feasible solutions from which one may be chosen by decision makers.⁹ Even those who would attempt to discover welfare functions by studying the political decision process rely upon the same assumptions of independence in consumption and production among the components of welfare.

The economics of quality requires that this assumption be examined. For example, if one component is important to welfare not only for its own sake but also for the production of another component, the calculation of trade-offs must provide not only for substitution but expansion or contraction effects as well [4, 27].¹⁰ Components of welfare are produced in both the public and private sectors in most countries. Not only do both sectors contribute to components of welfare, but each is dependent upon the other with respect to intermediate production. Law enforcement, for example, is important to property owners, and professional education contributes to the operation of many industries. At the same time the two may be

⁸ It is recognized that quality is only one of many issues involved in externalities, non-price competition, and market failure. The decision was made to neglect some of the elaborations necessary for a complete treatment of all of these issues to permit greater breadth. Professor Wanstorp called my attention to some of these complications.

⁹ It is recognized that in practice there is no sharp distinction between analysts and decision makers and that many individuals play both roles. Nevertheless, it is important to keep the two functions separate for analytical purposes.

¹⁰ The conceptual basis for this section of the paper is given in the Appendix.

competitive in the use of some, but not all, factors of production.

Toward a Social Report was issued in 1969 by the Department of Health, Education and Welfare [32] and is an effort to provide a framework for a system of social accounts. Seven components of welfare are identified in *Toward a Social Report* and are selected for discussion here. They are: (1) health and illness, (2) social mobility, (3) our physical environment, (4) learning science and art, and (7) participation and alienation.

Assume the indicator, per capita real income, is selected as a proxy for income and poverty, and then pose the question, "What happens to the other components as per capita real income changes?" This question can then be broken into subparts, and the concept of quality advanced earlier may be used in the analysis. Are the other indicators of welfare independent and separable from per capita real income in a decision context? For example, if it should turn out that a high density of population is necessary to industrialization and industrialization is necessary to increased per capita real income, but that a high density of population results in a decline in public order and safety, non-separability exists and choices will need to be made among alternative combinations of attributes or components of welfare.

A broad-brush summary of *Toward a Social Report* suggests a positive correlation of GNP with the pursuit of health, social mobility, learning science and art, and the reduction of poverty; and it suggests a negative correlation of GNP and the physical environment but uncertainty as to the relation of economic progress to public order and safety and participation and alienation. This crude empirical analysis indicates that economic growth does not automatically increase the range of either individual or social choice.¹¹ Objection may be raised to this association of indicators on the grounds that GNP includes an allowance for public sector activity in private sector terms. However, if a positive income elasticity of demand for public sector production is assumed, and if a negative relationship of a social indicator with GNP is observed, one must raise questions about one or

the other as an accurate social indicator or about the inevitable complementarity of economic progress and the quality of life.

But the matter simply cannot rest here. First, the particular measures of social progress chosen are, at base, arbitrary. The state of science does not permit us to know a complete statement of a social preference function, although it does seem conceivable that our political institutions are capable of yielding some information about what should be included in such a function. Second, the apparent statistical relationship among the indicators needs to be examined from a theoretical standpoint. While such an examination is necessarily *ad hoc*, it is essential for productive future empirical work.

An increase in national income and a willingness to make appropriate public investment may explain the positive relationship of economic progress and learning science and art. The application of knowledge and, again, requisite social investment may result in improvement in health and the prevention of illness. Social investment in education may increase social mobility. If poverty tends to be concentrated with respect to geography or race, lack of progress may be experienced in participation and alienation and public order and safety. *Toward a Social Report* makes the common fallacy of equating pollution with the physical quantity of material that has no economic value and assumes deterioration of the physical environment will be associated with economic growth.

Thus, examination of the *Report* from the vantage point of quality raises serious questions about the state of knowledge relative to some of the most pressing policy issues of our time. To what extent are the multiple components of welfare independent? Prior to a discussion of the multidisciplinary implications, some examination of the public sector's response to issues of quality is appropriate.

The same incentives do not exist in the public sector to encourage separability and precise product definition as exist in the private sector. The reason a good is being produced in the public sector may be because it was not capable of precise definition unless important attributes were neglected. It should be recognized, however, there is little in the bureaucratic incentive system that encourages precise product definition, and if such definition results in some effects being neglected, there may be little advantage to production of the good in the public

¹¹ Gary Seevers called my attention to the fact that the 1972 *Economic Report of the President* reported that GNP and health appeared to be unrelated [34, pp. 137-138]. For a recent statement on multiple policy issues as seen by the White House staff of the Nixon Administration, see [33].

sector. Efforts are being made to understand better the structure and motivation of bureaucracies [25]. Such understanding may lead to a better system of control and incentive which, in turn, may result in improved performance. The emerging field of public choice is an effort to focus political science and economics on this as an area for investigation.

Benefit-cost analysis in the water resources field, followed by the application of operations research techniques to defense expenditures and then to other public sector activities, may be viewed as a forerunner of the public choice field. Many of the issues currently being debated in this field were discussed much earlier in the literature on the economics of natural resources [9]. Yet, this more recent intellectual effort is still to be encouraged, because it should provide a better base for some of the naive measurement efforts that have emerged under the guise of efficiency in government [3].

Prior to the application of operations research techniques to problems of production in the public sector, some attempt should be made at the definition of product or commodity. Selection of a particular attribute in production or consumption, such as credit hours taught, and viewing this attribute as a proxy for a public sector good such as "education" is not likely to inspire the confidence or command the support of those who are engaged in either the production or consumption of the public good. Nevertheless, there will undoubtedly continue to be an attempt to impose on the public sector a type of discipline that is automatic in the private sector. While the discipline is certainly needed, the discipline will be more apparent than real if multiple attributes in both production and consumption are ignored.

Quality of life and multidisciplinary requirements

It is quite popular today to be on the side of multidisciplinary endeavors. Yet, it is usually the case that enlightened public choice requires knowledge that might logically come from many different disciplines. What may be different, however, is that future social progress may be related more and more to the actual involvement in public choice of people who can extract and integrate specialized knowledge from a number of disciplines. The best way of organizing to bring about this integration and provide for deeper penetration within disciplines simultaneously is unclear at this time. Even so, it

seems fruitful to examine the multidisciplinary requirements associated with public choice on quality of life issues.

It is apparent that hypotheses need to be constructed that will describe the relationships among the components of welfare, such as those presented in *Toward a Social Report*. Of course, one of the first products of such a work may well be the identification of components that will serve more adequately than those identified in the *Report*. Each discipline should have a comparative advantage in the construction of those indices that describe those components of welfare that fall in the respective subject matter fields. Further, behavioral scientists may well predict individual and aggregate response to alternative social policies. Political scientists and economists may contribute to the understanding of organizational forms which will permit decisions relative to the components of welfare. The framework of economics, however, will be necessary to keeping the relationship of means and ends in perspective, and our comparative advantage in the policy field should remain high.

Quality and resource economics

Formulators of public policy for natural resources have long recognized multiple objectives in the management of these resources. Yet, the application of benefit-cost analysis—a single criterion technique—was pioneered in water resource development. Currently, policies are being considered which would direct those agencies which seek to make public investment in water development to do multiple objective evaluation. The public agencies that have been involved in this undertaking have invited not only their own but also academic and foundation economists to participate. While we were not well prepared for the task, it is my opinion that what emerged was "better" than it would have been in the absence of this participation. I also believe that time will show that the general orientation of agricultural economists on this issue reflected greater breadth and flexibility than that of economists generally. Agricultural economists generally avoided the trap that results from accepting the proposition that economics is capable of dealing only with the national income component of welfare.

Question must be raised in natural resource planning concerning choosing among multiple objectives at a low level of aggregation. For

example, the rate of substitution between, say, environmental quality and income may be considerably different in the management of a unit of a particular resource than for an entire system. That is, an increment of environmental quality may require a larger sacrifice of income when a dam is being constructed than would be the case if income were maximized for the dam but diverted to environmental enhancement at a higher level of aggregation. For an additional example, if fishery enhancement is viewed for an entire region rather than for every stream or for every dam site on a stream, a very different set of fishery enhancement priorities may result. Thus, aggregation may be a powerful means of bringing about separability and meeting the economic problem of quality.

A decade ago the number of agricultural economists working on environmental quality problems could be counted on the fingers of one hand.¹² Today a very significant number of agricultural economists are devoting their talent and scarce time to this general problem. Problems of environmental quality have arisen because our economic system has ignored certain external effects. The aggregate impacts of mass production and consumption on the physical environment can no longer be ignored. It is to the credit of much early work in land and water economics that this interdependence was recognized and explicitly taken into account [5, 6, 9]. Nevertheless, the task remaining is to design an economic system that will include environmental quality as a product of the system. So long as the dichotomy of economic and non-economic goods exists, our task as economists is incomplete [29].

Quality and rural development

The economic literature on rural communities provides additional evidence of the failure of economists to go beyond a narrow definition of their product. We have been so concerned with commodities that we did not recognize that commodities, people, and geography are inseparable. USDA and land grant institutions are now attempting to organize and attack the problem of rural communities, and agricultural economists are in the forefront of the professionals involved.

It is an open question, however, whether rural development efforts can succeed in the

established bureaucracy. Many administrators apparently view this as a continuation of existing programs rather than as a new problem thrust. Others seem to believe it is an opportunity to save the existing bureaucracy. Regional centers are being asked to solve problems of regional research and research-extension coordination which have persisted for decades, which were caused by faulty organization and excessive fragmentation, and which are related to rural community development in only a most incidental way. After decades of starving social science research, USDA and the experiment stations are behaving as though a little short-run, applied social science research will yield tremendous dividends. With the exception of only a few, such as Earl Heady, responsible people in the establishment are failing to speak out on this issue. This is most disappointing, in view of the number of agricultural economists in responsible administrative positions in the USDA and in the experiment stations. The credibility of this profession as well as other social sciences will suffer if we continue to encourage unrealistic expectations for rural and community development research.

Extension personnel have long recognized there are multiple objectives associated with many group or community decisions and have often focused educational efforts on the identification of objectives. Sometimes these efforts have even extended to the identification of priorities for communities. Yet, if the effort stops at this point, it is certainly incomplete. Attention should also be given as to whether the objectives are independent or interdependent in accomplishment. Unless this can also be ascertained, group aspirations may be raised beyond what it is possible to accomplish. Rural communities are what they are because of powerful economic and social forces. While the effort to mitigate the effect of these powerful forces is laudable, there are limits as to what can be accomplished within the community itself. The technical and knowledge base for the identification of these limits seems to be missing from the rural development extension groups that have come to my attention. Because of the exogenous nature of the economic and social forces causing the rural community situation being addressed, a too-restricted concept of communities in the design of research and extension activities may result in such work becoming counter-productive. It is hoped the rural community will be the beneficiary of research

¹² See the Foreword to [30] for an impression of recent developments in this area of investigation. Also see [8] for a recent statement by a pioneer in the field.

and educational work; but it may not always be the best conceptual unit for the design of research and extension work.

While we can all be encouraged and pleased by the involvement of the behavioral sciences in rural development research and extension, if this work is to bear fruit it will need to provide a framework and an incentive for the continuing involvement of modern technology as rural problems are addressed. Further research, education, and other public sector programs will have moderate impact if integration of rural areas with the urban industrial complex does not occur.¹³

The Quality of Life and Economic Affluence

There are two remaining stops on our journey through the Land of Quality. The next stop will permit us to put the quality of life into perspective in the affluent society.

On the basis of the analysis to this point, the following can be concluded:

1. A fundamental conceptual base exists for the prevalent concern with the quality of life.
2. The framework of economics permits the economist a continuing role in the analysis of public policy, if he wishes to take advantage of that framework.
3. Environmental concerns have something in common with quality of life issues generally; both appear to stem from a common economic base.

Of the questions posed at the outset of this paper, one remains to be faced squarely. Why have we only recently identified quality issues as being of importance at this point in time? Is it because we are so "affluent" that we can now "afford" to be worried, or is it because something basic has gone wrong with our economic-political system? The difference is that of being prevented from moving to a higher point on a utility function and that of losing what has been gained and regressing to a lower point.

While the question cannot be answered without recourse to empirical data, it is possible to

establish a classification system that will assist in judging the possibilities. This system has two major classes. One class has been labeled *Income Performance*, the other, *Market Performance*.

Income performance

In this context income is equated with the production or consumption of an economic system that can be valued in the market place. Within this class two subclasses are useful: distribution and changes over time.

- (1) *Distribution of income*: It may be possible for a group to reach a consensus, based on ethical propositions, as to which of two distributions of income is the more desirable. Economics gives no assurance, however, that any economic system will yield, simultaneously, an ethically acceptable distribution of income and an efficient, or even an acceptable, allocation of resources [2]. Thus, it is conceivable that some of our concern with quality of life may be because there is an inappropriate distribution of income. If this is our judgment, devices for income redistribution would be sufficient to meet at least some of the problems of quality outlined. This point of view has articulate proponents in the profession.¹⁴ Complex multiple component analysis is not needed, because if income is placed in the appropriate hands, it will be transformed into other, more ultimate ends. In other words, government would be relied upon to redistribute income, but the allocation of resources would be primarily the responsibility of the private sector.
- (2) *Income changes over time*: If it is believed that the generation of a high level of national income is important as an intermediate product for the acquisition of other goals, then emphasis may be placed on (a) the performance of the economy and (b) the transformation of income into the production of goods produced in the public sector. If there are blocks or obstacles to the increased production and consumption of these public sector goods, dissatisfaction will likely result. The John Kenneth Galbraith who wrote *The Afflu-*

¹³ The scope of this paper is undoubtedly too broad as it stands, and the temptation was resisted to apply the multiple attribute concept to property rights and current problems of land use planning. In a forthcoming article in the *Journal of Soil and Water Conservation*, Bruce Rettig and I will make a modest beginning.

¹⁴ Milton Friedman is the name that comes first to mind in this connection, although many others have argued in this way for one or more social problems [14].

ent Society apparently believed this described reality at that point in time [15].¹⁵

It appears certain that some of the current concern with environmental quality can be traced directly to affluence. It would be most interesting to ascertain the strength of correlation existing between various kinds of environmental concerns on the one hand with the possession of income and wealth on the other. One would anticipate that those whose incomes are among the lower one-third in our society would view environmental issues very differently than those whose incomes are among the top one-third.

Market performance

Another possible inadequacy of the economic-political system relates to its inability to specify or value properly inputs, products, commodities, or components of welfare. For example, at one point in time, space, water, or air may have been so abundant as to be a free good. If this is no longer the case and if the system does not reflect this scarcity, it may be said the economic system has failed in a fundamental sense.¹⁶

The possibility of market failure has been of great interest to economists who have concerned themselves with problems of environmental quality and natural resource management. The inadequacy of incentive systems and the possible modification of these systems to correct specification errors have commanded the attention of most who have contributed to the subject.

A historic policy in this nation has been to use price as an incentive for development but an unwillingness to use it as a conservation device. Water, energy, education, land, transportation, and communication are examples of public utilities where abundance and low price have been used to encourage development and

opportunity. We are currently experiencing an increase in the rate of depletion of those natural resources which are especially in demand in an affluent society. Under these circumstances, a fundamental reexamination of this historic policy is appropriate. Economists have pointed to the role of the market in water development for at least three decades, but we have been largely ignored until recently, when political forces have required a fundamental examination of national water policy. As a consequence, non-economists are discovering that economic arguments can sometimes serve their ends. Two decades ago many conservationists viewed the interest rate as an obstacle to the making of public and private investments which they regarded as desirable. Today, environmental groups are among the strongest proponents for high discount rates to be used in the evaluation of public investment for natural resource development.

It is now possible to return to the central question raised by this stop on our journey. Is the present indisposition of our society the inevitable consequence of our affluence, or is it because of other causes? While a definitive answer cannot be found independent of empirical investigation, it is my judgment that:

1. A redistribution of income with a greater reliance on price and the market would bring about improved public policy in many problem areas. Some, but by no means all, of our discontent would be removed by such a policy.
2. Some of our discontent surely must arise because we are more affluent. The optimal combination of market and nonmarket goods in consumption will undoubtedly vary with levels of income. This may be especially true for environmental quality, but it will also apply to any collective good for which a high income elasticity of demand exists. When this is the case, improved public policy will consist not only of income redistribution but also of an increased flow of income into the public sector for the production of goods by the public sector.
3. There is substantial discontent associated with failures of the economic and political system to specify and relate economic and non-economic components of welfare properly. Of course, it is the message of this paper that this popular dichotomy of

¹⁵ It is recognized that there may be both agreements and differences between Friedman and Galbraith other than those identified. These names are used here for illustrative purposes and are not mentioned to suggest their total views on economic policy.

¹⁶ The term "market failure" has become the traditional way to describe the phenomena being included in this category and stems from Bator's 1958 article [1]. It must be noted, however, that "failure" as used by Bator is an absolute, not a relative, concept. In judging performance as a basis for action, the performance of the market should be compared to a realistic alternative, so that relative performance may be judged.

"economic" and "non-economic" is inappropriate and, if adopted by economists, would result in our isolating ourselves from some of the most significant problems of our times. For example, feelings of alienation and isolation will not be removed completely by income redistribution. Yet, the removal of such conditions will involve, in part, economic means and will have economic consequences as the term "economic" has been used traditionally. Thus, "economic" and "non-economic" components of welfare will no longer be treated separately if problems of quality of life are addressed as envisioned in this paper. It is with this third source of social discontent that we find a major challenge for all social scientists, but most especially for economists, dealing as it does with the adequacy of incentives for social systems.

The above suggests that the disenchantment being observed in our society has an economic base as well as perhaps other bases. There are those who are disenchanted because they are poor; there are those who are disenchanted because the private sector is not automatically giving them what they want and need; there are those who are disenchanted because they are so affluent they are satiated with market goods and are looking to the public sector to provide them with that which private wealth cannot purchase.

This disenchantment has political overtones. While the discontent has an economic base and, in an analytical sense, a common economic base, it cannot be removed by a common set of economic policies. Indeed, one can visualize severe conflict arising among the disenchanted as they attempt to reform this society. The "politics of quality" is the subject of a different paper, but one can speculate with respect to the duration of a political alliance based on the multiple sources of disenchantment which have been identified.

The Quality of Economics

The final stop on our journey is for the purpose of viewing the quality of our discipline and the performance of those who apply that discipline—agricultural economists. At this point, brevity is surely more of a virtue than is completeness; the treatment is suggestive rather than definitive.

The conclusion can now be drawn that the economics of quality should not emerge as a separate area of investigation. Such an area would include too much of what already permeates the literature. It would tend to create greater fragmentation when less fragmentation is needed. The paper does not support the notion that economists should abandon the traditional problems of employment, trade, and inflation; many of our social problems stem from an inadequate performance of our economic system as judged by these traditional measures of performance. Neither is it my message that all agricultural economists should abandon the problems of the farm and the marketing firm; nor do I believe the performance of the food and fiber system is of little consequence and should be neglected by agricultural economists.

There is a fundamental basis, however, for economists and agricultural economists to view reality in multiple dimensions. Within the private sector we need to consider all of the attributes that are capable of contributing to utility; in the public sector economists need to concern themselves with the economic problems of all components of welfare. The comparative advantage of economists in public policy is likely to remain high unless we concern ourselves only with optimizing national income or GNP and thus exclude from our analysis some of the most important, pressing, and complex problems of our time.

What, then, of the "quality of economics"? Does our discipline have the power to address these very important and central problems? When I view the immensity and complexity of the problems of our society, I tend to be pessimistic with respect to what economics and economists can contribute. When I work with other scientists—social, biological, or physical—on these same social problems, I come away with a feeling of pride in the comparative advantage of my own discipline. When I become involved with practical policy decisions and observe the errors that could have been avoided by the application of the principles of economics, I am once more encouraged and optimistic about the future of our profession and, on balance, that is where I stand today. As applied economists, we can be thankful we have an adaptable and a versatile body of thought which can be used to explore the basis for our society's discontent. We are saved from writing the "economics of quality" by the "quality of our economics."

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APPENDIX

It is assumed there are multiple dimensions to something called social welfare. The difficulties inherent in its measurement are recognized, to say nothing of optimizing such a quantity. Social institutions, however, may be capable of permitting the various components of welfare to be identified.

The models advanced are aggregate or macro in nature. Welfare, W_1 , is assumed to have numerous components, C_1, C_2, \dots, C_n . Some of these components must be created by the participants in the system; not all of the components are free goods. As a consequence, the components of welfare will require individual or collective inputs from the participants in the system in terms of labor, capital, and scarce natural resources.¹ The resources of society are represented below by the small x 's— x_1, x_2, \dots, x_n .

¹ In the following discussion, independence is analogous to separability in the product-commodity attribute case. Again, it is recognized that jointness or separability depends on both production and utility functions.

There are at least three interesting possibilities from the vantage point of this paper.²

Case I

In this instance it is assumed that the components of welfare are independent. An analogous case might be found in production economics theory, where two products are competitive for some of the same resources. For convenience, we assume there are only two components:

$$(1.1) \quad C_1 = f(x_1, x_2, x_3, x_4)$$

where $x_1 \dots x_4$ are inputs from either the public or private sector, and

$$(1.2) \quad C_2 = g(x_1, x_2, x_3, x_4, x_5).$$

In such a case it is appropriate to treat the two as competitive. "Trade-offs," as the term is usually used in the cost-effectiveness analysis literature, would appear to be appropriate. The policy issues here are quite straightforward, and it appears that much of the literature on public policy assumes this to be descriptive of reality.

Case II

The concept of intermediate products is essential to an understanding of this situation. In this instance there are two components of welfare. One, say, national income, is competitive with another, say, education, with respect to resources. But it also recognizes that one, say, education, becomes an intermediate product in the production of another, say, national income. Here,

$$(2.1) \quad C_1 = f(x_1, x_2, x_3, x_4)$$

$$(2.2) \quad C_2 = g(x_1, x_2, x_3, x_5, C_1).$$

In this instance, C_1 is again ultimate as well as intermediate as a component of welfare. However, it is competitive with respect to C_2 in regard to inputs. Substantial interdependence exists. Decision rules and techniques involving

"trade-offs" will need to be quite sophisticated to sort out and account for both the complementary and competitive aspects. For example, C_1 might represent income from the private sector and C_2 might represent a component produced in the public sector. One activity is essential to the other, but it also is competitive with respect to the use of inputs.

Case III

In this instance, even greater interdependency is illustrated. Each component of welfare is also an intermediate product in the production of the other. Furthermore, the two components are competitive in the use of resources.

$$(3.1) \quad C_1 = f(x_1, x_2, x_3, x_4, C_2)$$

$$(3.2) \quad C_2 = g(x_1, x_2, x_3, x_5, x_6, C_1).$$

In this case the production of each is essential to the other, but they must also compete with respect to certain inputs.

If either Case II or Case III prevails, it is doubtful that the existing literature on "trade-offs," in an operations research sense, will be applicable. The body of this paper suggests that Cases II and III may be more representative of reality than Case I.

In the private sector example presented earlier, jointness or nonseparability was viewed as being physical in origin. Different attributes of a given product or commodity were identified. In this multiple objective section, nonseparability should be viewed as also being institutional in origin. Thus, Cases II and III may be more descriptive of our society than is the other case presented. The literature on "trade-offs" is probably misleading or inapplicable because of the potential existence of both complementary and competitive influences.

It is hypothesized that our institutions reflect both the independent and the interdependent nature of the relationships. They adapt, adjust, and reflect changing conditions. It is not clear, however, that some institutions are capable of generating incentives that will lead to greater separability and independence as was hypothesized for the private sector example.

² In the presentation of the following cases, we have abstracted from the private-public sector dichotomy. However, once the cases have been presented, it is assumed that resolution of conflicts will probably occur in the public sector.

INVITED ADDRESS

Southern Tradition and Regional Progress: A Perspective from the 1970's

WILLIAM H. NICHOLLS

To look up and not down,
To look forward and not back,
To look out and not in, and
To lend a hand.

—Edward Everett Hale

IN 1960 I published a book, *Southern Tradition and Regional Progress*, which (by my very modest standards) was a "best seller." How much influence, if any, it may have had on subsequent events, I do not know. But at least it gave me the opportunity to get out of my system some strong views which I felt—as a Southerner and as an American—needed to be said and were then being voiced inadequately or not at all.¹ I am flattered that our President Vernon Ruttan at least remembered my book and felt that it might be worthwhile for its author publicly to take a new look at his analysis of the Southern region after more than a decade had elapsed. I welcomed the opportunity because, once again, our region and nation are at a crucial stage of our history in which—after much progress on some of the basic issues of regional economic development, race, and poverty—we are threatened with the

imminent possibility of serious economic and sociopolitical retrogression.

In my book of a decade ago, I analyzed in detail the principal tenets of Southern tradition and their combined effect as a strong barrier to regional economic progress; argued that Southerners must—insofar as their foremost objective is the achievement of higher per-capita incomes—choose between tradition and progress; and called for effective and constructive leadership on the part not only of the South's politicians but also of its privileged classes in making a smooth and successful transition from the tradition-bound Old South to the progressive New South. I believe that my 1960 analysis of the South's traditional values is still valid if one is to understand the region's sociopolitical attitudes of today, still significantly influenced residually by the heavy hand of the past. On the other hand, the South continued to make remarkable economic progress during the 1960's, further weakening the hold of tradition almost in spite of itself. As the South further closed the gap in industrial-urban development, and as continued outmigration from the South spread blacks more evenly among regions, the South has increasingly become more like the rest of the nation in its aspirations and value systems. Hence, its sociopolitical shortcomings have more and more become those of the nation as a whole, shortcomings which have been exacerbated by the "Southernization" of the North as it faced increasingly a "race problem" of its own and by incredibly unprincipled and cynical national political leadership. Let us consider these matters in greater detail.

Recent Regional Economic Progress

The extent to which the South has since 1940 closed the economic gap which had long existed between itself and the nation as a whole is easy enough to demonstrate. Since 1940, the South,

¹ It is unfortunate that this Invited Address was presented at the beginning of a presidential campaign, the coincidence of which may have made my remarks appear excessively "political," even though my argument would have been little changed in the absence of a current political contest. Like my book, this paper was a type of "social analysis" or "social criticism" which—despite the obvious dangers of dealing with current history—has at least some "objective" value (if social science can claim any) which cannot be invalidated and certainly not "repudiated" by the subsequent election returns of November 1972. To be sure, it is clear (after the fact) that Nixon's "Southern strategy" was *politically* successful and that among other things it had a strong appeal to the rest of the nation. Nonetheless, my principal arguments—the absence of "moral" leadership (however politically unpopular) by the President and the "failure of the national will" on desegregation on the part of the electorate at large—still stand and have indeed been partially confirmed by the election results. The President now has a new four-year mandate to demonstrate whether or not the consequences will be as serious as I have projected them to be.

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so long predominantly rural and agricultural, has urbanized at a rate 68 percent higher than that of the nation as a whole. As a consequence, during 1940-1970 its share of the nation's urban population grew from 21 to 30 percent, while its share of the nation's total population remained constant at around 28 percent. During 1940-1960 the South's share of the nation's manufacturing employment increased from 17 to 20 percent and during 1960-1970, its gain being more than twice the national rate of increase, reached 23 percent. During the 1960's around \$27 billion, much of which came from outside the region, was invested in new plants and equipment in the South with a continued upgrading of its industrial mix. In the single year 1971, new industrial development in the South reached \$4 billion with the prospect that its industrial development would continue to accelerate. The South has also continued to show rapid gains in employment in the service sector, the mark of a more affluent regional society.

Most important, during 1940-1970 real per-capita incomes in the South increased from 58 percent to 82 percent of the national average, much more rapidly than in the nation as a whole. (That this favorable trend continues is shown by the fact that as an example the growth rate in per-capita incomes in Tennessee has exceeded the national growth rate during three out of the last four years, including 1971 when nonagricultural employment increased by 5.0 percent as compared with only 3.5 percent nationally.) Perhaps more impressive in terms of per-capita time and demand deposits in commercial banks, the South rose from only 30 percent to 77 percent of the national average during 1940-1970. Thanks to its banks and other growing financial institutions, including sizeable life insurance companies, the South has largely broken the historical pattern of capital scarcity and high interest rates from which it has suffered so long. Thus, by almost any standard the South's economic progress since 1940 and particularly since 1960 has been quite remarkable, indicating the presence of a dynamism which would appear likely to close rather soon the relatively small gap which yet remains.

In the process the South's long-time drain on human resources (by out-migration to other regions) has finally reversed itself. After losing some 3.5 million people (81 percent black) by net out-migration during 1940-1960, the South experienced during 1960-1970 net *in*-migration

as the entry of new whites, bringing higher skills and higher personal incomes, more than offset statistically the exit from the region of more than a million additional blacks. Furthermore, with increasing problems in the ghettos of the nation's largest cities and improving conditions for the South's urban blacks, even the outflow of blacks from the South has been significantly reduced, particularly since 1965. Thus, the migration of Southerners has increasingly become internal to the South and in those Southern states favored by the presence of major cities has even been largely an intrastate rural-urban movement of very heavy proportions. Those Southern states and regions (notably Appalachia) which have lagged behind in industrial-urban development have shared far less in the region's economic progress, and while their absolute numbers have been greatly reduced during the last decade, the South's poor, both white and non-white, remain numerous compared to the rest of the nation. Probably never in Southern history have the rural-urban differences in wealth, income, and economic opportunity been so marked. After prevailing for a century or more, rural poverty in the South is slow to die. While most rural counties of the South continue to have considerable out-migration, the potentially productive people who remain behind—quite apart from the old and disabled—are increasingly an important part of a stranded rural non-farm population created since agricultural employment went into sharp decline. Thus, while its cities are now prospering, the South's remaining areas and pockets of rural poverty now constitute its major economic problem. With the magnitude of this problem of rural poverty at least reduced, and with rapidly increasing financial resources now available from its own industrial-urban centers, the South can now solve this problem if there is both a community will to do it and effective political and business leadership.

The Declining Hold of Tradition

That the South has made so much progress in the past few decades was possible because its dominant forces, if somewhat reluctantly, chose progress over tradition. As these forces gained momentum after 1940, the hold of tradition was weakened and in important ways has even disappeared.

Perhaps the first to go were the *dominant agrarian values* so dear to the Southern heritage.

No longer is an industrial-urban way of life scorned anywhere in the South. No longer are the planter's socioeconomic views insulated from competing economic forces. Indeed, if he has preserved his influence by conservative alliances with industrial-commercial interests, the planter has probably given more than he has received on such questions as taxes, tariff protection and quotas, social policies, and the like. Increasingly, the South's new industrial-commercial elite satisfies its traditional love of the land and the outdoors by luxuriant suburban acreages—probably as an intermediate step to less demanding high-rise apartments with less grass to mow and fewer gardens to supervise—and by frenzied hunting or fishing trips which are increasingly difficult to work into heavy business schedules. The old agrarian tradition of leisure is no longer strong enough to discourage enterprise on the part of the *nouveau riche* for whom the mass cocktail party at the best local country club has largely displaced the more informal and friendly “drinks at five, come as you like” of not so long ago. The sons of the New South, like their counterparts in the rest of the nation, have embraced progress at the expense of recreation and even “gracious living,” a trend that all Southerners must view with some nostalgia if not with full disapproval. If the old attitudes produced (and even gave sanction to) laziness and lassitude on the part of poor whites and Negroes, the new attitudes have, if anything, hardened the social judgments of the wealthy toward the poor. Having become far less lazy themselves, the new wealthy can more easily rationalize the poverty of their lesser brethren by saying that such people are poor “only because they want to be poor” or (in a leap of interpersonal comparisons perhaps tinged with a trace of envy) that the poor “like to hunt and fish anyway.” In any case, no longer being able to take refuge in the old political ploy of refusing to reapportion legislative districts which virtually disenfranchised urban voters, the residual agrarianism of the rapidly declining rural areas is no longer a dominant social or political force in Southern society.

The traditional *rigidity of the South's social structure* has also been seriously weakened in recent decades, largely in proportion to the declining dominance of the old, carefully stratified rural society in which first the black, and later the typical poor white, had his place. In the U. S. South, as in Latin America, the rise of the

middle class has been a largely urban phenomenon. The abnormal subordination of the South's *rural* middle class to a sociopolitically dominant landed aristocracy had sharply reduced middle-class contributions to the democratization and economic development of the Southern region. In the new and freer urban environment of recent years, the Southern middle class has become a much more influential factor. While the urban middle class has contributed much of the new commercial and industrial leadership, it (like its Latin American counterparts) still feels somewhat insecure socially and politically, being torn between aspirations shaped by the South's old “aristocratic ideal” and certain populist sentiments based on resentment of the “old-family” dominance from which they have sought escape. The most successful of their numbers have moved by affluence or marriage into the old (but thus partially renewed) privileged class, increasingly Republican in fact if not in name; others still find attractive the peculiar mixture of racism and populism represented by a George Wallace. Although this urban middle class has on balance been an important democratizing influence, it too has been strongly infected with the extreme individualism which led the old Southern aristocrat to hold that his less fortunate neighbors were wholly responsible for themselves rather than being either his responsibility or a product of the social system, and to accept as normal and inevitable socioeconomic arrangements based on a disproportionate number of low-income people. At the same time, although somewhat less than those members of the “old families” who have succeeded in making the transition from landed to industrial-commercial wealth, the urban middle class has tempered its harsh social judgments with elements of the old *noblesse oblige* under which lesser people have received, on the strictly interpersonal level, great kindness and consideration. On the other hand, those who still practice *noblesse oblige* are hurt and alienated by those Negroes or poor whites who increasingly recognize and resent the master-servant relationship which it implies, preferring a less dependent if more impersonal situation. Here the difference in racial attitudes between Southern and non-Southern whites has been well described by the Negro comedian Dick Gregory: “In the South, the white tells the Negro, ‘I don't care how close you get, but don't get too uppity!’ In the North, the white

says, 'I don't care how uppity you get, but don't get too close!'"

At the other end of the urban social scale remain relatively large numbers of low-income whites and Negroes. Thanks to their growing power as an important voting bloc, urban Negroes have become a political factor which Southern whites must court as never before. Furthermore, if painfully slowly, urban Negroes of the South have become an ever-growing economic factor whose threats of business boycott can often win concessions from commercial enterprise. Indeed, among urban Negroes too there has been the emergence of a significant black middle class, torn between its success in separating itself economically and socially from the black masses and its feelings that it has an obligation to help its lesser brothers and to be increasingly active in providing the leadership needed to strengthen racial pride and solidarity. As has always been true, the urban Negro's evident economic progress has been most resented and feared by low-to-middle-income blue-collar white workers, bringing from their recent rural backgrounds the strong prejudices previously nurtured by a social structure which at least clearly supported their claims to superiority over the Negro race. Certainly they have always been the principal instrument for carrying out racial violence and the strongest pool of political support for George Wallace's populist and half-concealed racist views. Nonetheless, the dominant industrial-commercial class and moderate local political leaders of today's Southern cities have kept all of these divisive factors under control through generally restrained and constructive leadership which has defused the old passions and if not preventing protest, has at least kept most of it nonviolent. That they have done so has often been more out of pocketbook considerations, both local and national, than out of any personal convictions based on notions of social justice. But by and large the results have been nearly as favorable. In the process, with more even-handed justice and improved economic opportunities for all, the urban South has recently made substantial strides toward reducing, if not yet eliminating, the old rigidities of social structure which so long handicapped the region.

Perhaps the most striking change in the South during the last two decades came from basic improvements in the region's *traditional undemocratic political structure*. The *post-bellum*

Southern landed aristocracy was able to construct a monolithic political structure, based on the overriding end of maintaining white supremacy which combined blind sectionalism with a negative and defensive States' Rights doctrine and depended for its survival on having a narrow electorate in which the suffrage of most Negroes and many whites was sharply restricted. As a result, black-belt whites were able to end the threat of agrarian radicalism and maintain a heavily disproportionate political influence over the rural masses, while thanks to the failure to reapportion legislative districts as heavy rural-urban population movements took place, they were long able to insulate themselves from the sociopolitical counterforces of the region's incipient industrial-urban development. First challenged by the New Deal, this system was largely brought down by two remarkable decades of Supreme Court decisions and federal Civil Rights legislation which outlawed poll taxes, literacy tests, and discrimination in voter-registration and voting procedures; ended *de jure* segregation of schools and other public facilities; ordered decennial reapportionment of federal and state legislative districts based on the "one man, one vote" principle; and prohibited racial discrimination by private businesses in terms of both the public they served and the people they employed.

At each step of the way the old political leaders vowed their eternal defiance and often openly invited violence. But the combination of firm leadership in enforcing from Washington court decisions and federal legislation and of the broadening and strengthening of the franchise for blacks and the more liberal urban vote which followed soon brought the election of more responsible and moderate state and local leaders who could channel the body politic along the path of peaceful and constructive compliance. Never was a sociopolitical revolution established more effectively or assimilated more rapidly, considering the deep-seated and emotionally potent traditions which had to be overthrown. Despite the ugliness of some of the initial incidents, the South solved this most difficult of problems in a remarkably lawful and orderly way—certainly far better than the way the Ulsterites (from whom so many Southerners have sprung) have been able to solve their comparable Catholic minority problem. That the South has done so well owes much to the patience and good sense of its blacks, to the

pragmatism of its emergent industrial-commercial class, and to the intellectual leadership of many leading Southern journalists and educators, who, in proving that not all Southerners were racist or reactionary, kept the debate open until more rational voices could prevail.

To be sure, the current Southern political scene has been becoming increasingly conservative—the substitution by Tennessee's electorate of Senator Howard Baker and even William Brock for such liberals as Senators Kefauver and Gore is a case in point—reflecting the conservatism of the South's new industrial-commercial interests as well as traditional attitudes which are still *laissez-faire*, individualistic, and militaristic. Nonetheless, the South's new conservatism is much more broadly based and for the first time in more than a century reflects the renewed viability of a two-party system in the region. If it is the Democratic Party which now appears to be weak in the South, it is largely because even today (George Wallace notwithstanding) the South's lower-income people have not yet been adequately organized or mobilized in such a way as to overcome their civic apathy and generally poor educational status, as reflected in relatively low voter-participation rates. The weakness of Southern labor unions, divided as they are by race differences which strengthen the hand of anti-union employers, has also been a contributing factor. Thus, with most legal barriers to the suffrage finally removed, the principal beneficiaries have not yet fully seen their common interests or exercised in sufficient numbers their collective political power in order to take full advantage of their new situation. When they do, as they surely will in time, more meaningful political contests, based far more on social issues and less on personalities, will probably become the order of the day.

If the South's lower-income people have not yet learned fully how to fend for themselves politically, the *weakness of social responsibility* in the Southern tradition has long assured that the wealthier classes will not be very ardent in their defense. A hundred years after the economic and biological determinism of an Adam Smith, Darwin, or Mendel had reached its zenith of acceptance in America, such views, albeit in much diluted and very naive form, still constitute a considerable part of the folk beliefs of the South's more privileged classes. In a culture in which interpersonal relationships have always been of such basic importance, the

notion of "society" as an instrument for collective change and improvement is a meaningless abstraction with little appeal. Many Southerners still hold the view, although less openly defended now than 30–40 years ago, that social and economic circumstances, being environmental, are of little importance since they cannot affect the *biological* qualities of succeeding generations. A. C. Pigou, without denying the biological premise, long ago refuted the sociological conclusion by writing that "the environment of one generation *can* produce a lasting result. Environments, in short, as well as people, have children." Significantly, he added, "If increased wealth removes influences that make for the elimination of the unfit, it also removes influences that make for the weakening of the fit." Far more than in other parts of the country, such arguments have largely fallen on deaf ears in the South, where most middle and upper class whites still hold firmly to the belief that the South's low-income people are poor simply because they are innately inferior and lazy.

Even here, however, such traditional attitudes are being slowly eroded. First, much of the dominant new urban industrial-commercial class has come to recognize that they are already benefiting financially from the modest amount of economic progress that low-income whites and blacks have already made and—persuaded by "green power" if not "black power"—are therefore not wholly disinterested in further improvement of the status of low-income people. As a consequence, although their basic conservative instincts are closer to Barry Goldwater's than to a Robert Taft's, it is now quite conceivable that this new urban elite will come to accept the notion of a guaranteed minimum family income as not only far superior to present welfare programs but more consistent with their own economic self-interest. Second, on the whole this class has also been favorable toward the South's public school system and institutions of higher learning as a means of upgrading the South's manpower pool. While the wealthier members of this class still opt for private schools in educating their own children, they recognize far more than ever before the relationship of a strong public school base to the region's economic progress. Its less affluent members, themselves dependent upon the public school system, have greatly broadened the support for public education. Most significantly, as never before, low-income urban

whites and blacks look upon education as the key to greater economic opportunity for their children although, given the intellectual poverty of their home environments, the young may not always respond as well as their parents would desire. Although this class of whites has resented most such new developments as school integration and busing, it is surprising how many of them have nonetheless expressed their opposition to demonstrations and boycotts which threaten to close the schools even temporarily. Third, as improved education has begun to pay off among blacks, more and more of them as members of the emerging black middle class come before the public eye in their new role as cultured, articulate, and intelligent citizens, gradually eroding the old stereotypes of the shuffling, shiftless, and ignorant Negro. In addition, as blacks have become more insistent on their rights and more self-respecting, they have helped to build up the respect they receive from others.

Thus, despite the fact that the new urban elite still holds nominally to many of the political tenets of the old rural aristocracy, this dominant new group is more moderate and flexible and less defiant and intransigent in recognizing that old traditions are not always in its economic self-interest. Most important, the traditional pressures toward conformity of thought and behavior—with violence the ultimate weapon against nonconformity and dissent—have broken down before the pluralism of a dynamic new Southern urban society, to the major benefit of the general intellectual environment and the quality of the region's colleges and universities.

On the whole, I have thus far presented an optimistic picture of what has happened to the South since 1950 or 1960. The region's economic progress has been remarkable. While I have shown that remnants of the old Southern tradition are still clearly discernible, it is equally clear that those elements of that tradition which most seriously threatened the region's economic progress have been largely abandoned or pushed aside because, where progress was at stake, tradition was given the lower priority. In recognizing the necessity of such a choice in 1960, I also called for the wise social, economic, political, and intellectual leadership which was essential if progress was at last to triumph over tradition in the Southern region. My review of the 1960's suggests that such leadership was indeed forthcoming in substantial supply, much

of it effective because a series of American presidents from Truman to Johnson vigorously enforced compliance on civil rights, placing the new Southern leadership on the side of "law and order" which all but the most intransigent Southerners respected and obeyed, whatever their private sentiments. Hence, I would certainly not have felt in 1970 the same irresistible urge to write my original book that I did in 1960. However, developments of the last two or three years have raised new problems, particularly in the area of race relations, which I find very ominous for both the South and the nation. Let me, therefore, continue my analysis with a look at the current situation which threatens to reverse much of the progress which the South has made during the last decade.

The New Reactionism: A Failure of the National Will

From the point of view of the Southern traditionalist, the period 1948–1968 was a new Reconstruction Period in which a vindictive North once again imposed its own social views in a punitive manner upon a stricken region whose special race-oriented problems were little appreciated or understood. Indeed, there are some important historical parallels with the years 1865–1876, during which a federal policy of radical equalitarianism for the South's manumitted slaves was ruthlessly pursued, consolidating Southerners into a monolithic unity against the outside world which survived almost unaltered for 70–80 years. Whatever their excesses, however, the radical regimes of the Reconstruction period generally adopted new state constitutions and passed statutes which embodied important social reforms in such fields as property taxation and public school education. These gains as well as excesses were ended by the "Southern strategy" of another Republican, Rutherford B. Hayes, who in 1876 won his disputed presidential race with Tilden by a deal with Southern planters and townsmen schooled in old-line Whig conservatism. The result, according to Vann Woodward, was a political alliance between Southern and Eastern (initially Republican but soon Democratic) conservatives from which the South gained *laissez-faire* on matters of race as their *quid pro quo* for *laissez-faire* on matters of business and finance, a small price since the industrial element of the Southern conservative coalition welcomed the latter as well.

While some of the radical reforms proved to

be too popular to be eliminated by outright amendment and appeal, the Southern conservatives' control over the public purse strings was effective in starving them to death. Thus, the failure of the national will which Hayes personified ended the hope for achieving much needed social reforms in the South. Now left to their own devices, the Southern conservatives preached one-party white solidarity but—still able to vote their black dependencies *en bloc*—stirred up little racial animosity. The sudden upsurge of Southern Populism in the 1890's quickly changed this. To head off this new farm-labor radicalism, which appealed to Southern farmers and industrial workers to close ranks in pursuit of their common class interests and sought to unite both races for their joint economic betterment, the Conservatives won the allegiance of the poor whites by turning a moderate doctrine of white solidarity into a vicious, brutalizing, and all-powerful sectional tenet of white supremacy. By arousing the basest passions of low-income whites, the conservative planters won their support for the disenfranchisement of Negroes with promises that such whites, far from being disenfranchised too, would gain a stronger voice. In the end, however, the ruthless and undemocratic methods by which the Conservatives pushed through these restrictions showed that their promises were at best empty ones. In the end, most poor whites were also removed from the electorate, assuring the planter class that they would also be insulated from the virus of agrarian radicalism and dangerous two-party movements. Thus did the unprincipled political ambitions of a would-be Republican president serve to turn back the clock for more than half a century by enabling the black belt planters, in V. O. Key's words, "to subordinate the entire South to the service of their peculiar local needs."

Today we once again face the serious threat of a similar period of social and economic retrogression. In the words of the distinguished Southern-born journalist Tom Wicker, President Nixon's recent proposal on busing is "the shabby and cynical political device of a President at home in such dealings . . . but also recognizes and represents a profound failure of the national will, comparable to but more dangerous than the abandonment of Reconstruction little more than a century ago." Let us further consider these matters of presidential leadership and the "national will."

As another perceptive journalist, Anthony Lewis, put it so well:

In just two decades [our] pattern of segregated life has been broken in law and in fact. It has been one of the great social and moral achievements in America's history, perhaps the greatest. And it has been made possible by two principal factors: the place of law in the American ideal and presidential leadership.

The South met court orders with evasion and delay and violence; but the courts stood firm, and in time they awoke this country's faith in law. The crucial political act was President Eisenhower's intervention against the mob in Little Rock. After that every Southern politician knew in his heart that neither the legal nor the political system could be moved from the course of desegregation.

It is that history, that achievement of the last 20 years, that President Nixon's program against school busing now threatens. Of course the President has not said that he wants to return to a segregated society. But there are reasons, both practical and psychological, for believing that his program may stop the momentum of desegregation and even reverse it.

. . . The impression Nixon sought to create . . . was that he could stop the courts and the Constitution—that he would stand in the school bus door, so to speak. Those who want a segregated America are not going to miss the message that at last they have a President who will bargain.

I agree completely with this statement which wholly accords with the facts. But, given those facts, I believe that Lewis should have added that given the unrelenting pressures from Washington, the South did buckle down and make substantial strides toward desegregating its schools. In the process, it finally lopped off most of the arcane legal apparatus which had previously penetrated and ossified every part of its being, not only freeing its energies for concerted economic development but at last saving its soul from a century of bigotry, deceit, and hypocrisy. Thus, if little appreciated at the time, the new social arrangements, however imposed, were the greatest favor that the South could have received.

To be sure, one can find much to criticize in what has yet been accomplished in Southern school integration. For example, in a recent article in the *Saturday Review*, John Egerton, while noting that Nashville has less racial isolation in its schools than most other cities, North or South, still finds that because of a failure of

leadership from the President to the local school principals, Nashville school children and the city are "victimized by a desegregation plan that is less comprehensive and less equitable than it should have been, and a school hierarchy that has become resigned to a mechanical shifting of bodies, but not to the much larger task of changing attitudes (including its own) and a power structure still dreaming of a reprieve from the courts or a rescue by the President." Thus, he argues, the outcry against busing has made it possible to be a "sophisticated racist" by saying, "We are against busing, not integration." Yet he concludes, "the result is the same: the white resistance at last has found a sophisticated means of opposing the drive toward equal educational opportunities [for] minorities and the poor without resorting to the language and tactics of the past." He does note the terrible cynicism of the politicians who, having put into effect this particular plan—approved by Attorney General Mitchell and HEW Secretary Richardson, with the acquiescence of Tennessee's governor and two senators, all Republican, as well as the federal district judge, also a Republican appointee—then joined the hue and cry against the "havoc" it is causing.

While essentially correct, Egerton's criticism misses the main point. Despite overwhelming opposition to busing and a non-violent two-week boycott at the opening of its schools in September 1971, Nashville carried out the new court order requiring busing on a massive scale peacefully and without serious incident. In practical application, the plan did work a severe hardship on many parents because, given the shortage of buses, school hours were widely staggered, a situation which more buses would clearly have solved. However, President Nixon quickly proscribed this solution by declaring that no federal funds could be used for this purpose. I am convinced that, had this practical problem been solved, the Nashville plan would have been worked out if effective presidential leadership, in this instance as elsewhere, had been forthcoming and if Southern resistance had not taken new heart in the opposition developing in cities outside of the South. Of course, the busing issue was made to order for Governor Wallace even though, according to a report of the Civil Rights Commission, there is less busing today in Alabama than there used to be under full segregation.

With Wallace's recent successes, most politicians ran for cover, including Southern mayors, but the latter could still fall back on the generally accepted defense that they had to obey court orders. However, worst of all, in Tom Wicker's pungent phrase, President Nixon "*descended* to the occasion." Far from trying to calm fears, talk sense, and appeal to reason and the generous instincts of the people, Nixon joined Wallace in fanning the flames. When Congress nonetheless produced a weaker law than he had sought, Nixon reverted to talk of an anti-busing constitutional amendment, a step which, in my opinion, would sully our most precious document. Little wonder that implementation of busing plans in Nashville and elsewhere has been less smooth than one might have hoped. Significantly, when Nashville recently carried its case to the Court of Appeals, Nixon's intervenors from the Justice Department were quickly set back on their heels by the judges. Now ready to file an appeal with the Supreme Court, which could easily have a Nixon majority by the time the case is heard, Nashville political leaders have had no alternative to a further appeal, given such Presidential encouragement. In my opinion, as in every other case involving the race issue during the last 20 years, Nashvillians, having taken advantage of every possibility of legal delay, would ultimately have accepted busing fully and effectively if the President had taken a firmly constructive instead of negative position on the matter.

But admitting that we now have a President lacking in any sense of moral imperative, why has Nixon, as a wholly political animal, suddenly reacted as he has done? To be sure, he owes his election in 1968 in considerable part to his pledge of relief to Southern segregationists. Upon taking office, however, he found that he could not keep his pledge to restore "freedom of choice" so that desegregation of the South continued. But, says Tom Wicker, "once the effort moved outside of the South, once Detroit and Boston and Denver and San Francisco became the target of the courts, once the whole nation had to face what it had loftily forced on the South, its nerve failed, and fear and hysteria filled the air." Suddenly it was shown that, if one scratches below the surface, he finds that there is a strong virus of racism in *all* white Americans. (During the Pontiac disturbances of last fall, as presented on television, I listened

in vain for Southern accents as the most vehement protesters spoke and was struck by the substantial violence there and elsewhere as compared with Nashville.) George Wallace was quick to exploit this fact—his performance in the Michigan primary almost matched his performance in the Southern primaries—but, demagogue that he is, he was only acting according to form. What was unforgivable was our President's haste to become America's "white-collar Wallace."

To be sure, the South's initial reaction to Nixon's request for a moratorium on new court orders was skeptical and even a bit angry. Northern cities, the most heavily segregated in the nation, would be spared any further desegregation (impossible to accomplish without busing), while most Southern cities, already under court orders to bus, could probably count on no relief. With an eye to his "Southern strategy," Nixon also proposed that busing legislation should provide that where court-ordered desegregation is in effect, the cases "shall be reopened and modified to comply with the provisions of this act." However, current court decisions, still short of the Supreme Court which Nixon has now substantially restructured, are not giving the South much hope of "relief." Thus, there is an attitude abroad that at least the "wicked South," given its sins of the past, will not escape the "national commitment" to desegregation. What all of this ignores is that any further distinction between *de jure* segregation in the South and *de facto* segregation in the rest of the nation is a fraud and a sophistry. Racial segregation is now a national rather than a Southern problem and demands a national solution to which the new South, however reluctantly, has already contributed more than its share. If the President and Congress tell the North, "You need not bus and, therefore, you need not desegregate," every Southern community presently under court orders will also have an irresistible case for demanding what its Reconstruction forebears called "redemption." Now, as a century ago, such a solution would set the South back by many years not only sociopolitically but also, by diverting Southern energies back to the same stale old issues, economically as well. Even worse, if the hypocrisy of the rest of the country on race relations is thus revealed, the South's efforts to "redeem" its very soul would have been for naught as the nation as a whole, in a great failure of national will and moral leadership,

moves in the opposite direction. For some time I have believed that the stage is now set for the South to solve its ancient race problems well before the rest of the country does. If the South now fails to do so, it will be because the other regions revive its still latent basest instincts by showing that they fully share in them.

The Need for Reordering Our Priorities

While my primary concern with current race issues has caused me to emphasize the lack of moral leadership at the presidential level, it is equally important that we find new leadership which will enable us thoroughly to reorder our national priorities. Because of the South's recent economic progress, even its socioeconomic needs are increasingly indistinguishable from those of the nation as a whole. Like the rest of the nation, the South needs above all official recognition that after 30 years of overweening emphasis on defense and foreign wars the United States is in imminent danger of collapsing from within because of the cumulative neglect of its internal problems—the plight of the cities, the sad state of our transportation system, excessive rates of inflation and unemployment, inadequacies of health and medical care, financial stringencies in education and other essential public services, the extent of poverty both urban and rural, and so on. The eagerness of the Pentagon to devour the whole "peace dividend" which the end of the Viet Nam war has promised is now readily apparent. The spectacle of Secretary Laird demanding more Congressional appropriations for armaments before the engines of the Presidential jet had cooled from the flight following the Moscow "arms limitation" agreement should give us pause. How long before we have a President with the courage and insight to say "So much and no more!" to the bottomless pit of Pentagon "overkill?" Unless we finally turn back to finding solutions for our many now overwhelming domestic problems, the outlook for our future (including our broader national security) is grim indeed.

Unfortunately, I cannot promise much help in this direction from our Southern constituency. While Southern mayors and governors would welcome federal relief in the form of revenue-sharing, their problems of public finance are still far less severe than those of the larger cities in the rest of the nation, in part because Southern cities are smaller and newer

and are faced with less severe unemployment and ghetto problems. In addition, Southern political leaders have thus far faced weaker demands for social services and have felt less political pressure for alleviating poverty, given the region's traditional antagonism toward such policies and the still relatively weak sociopolitical organization of the less privileged. Insofar as the South's social problems are less severe or, though serious, have simply not yet been as fully recognized or met, the South probably feels less deprived than other regions. At the same time, having once been brought down by force of arms, the South also is the region most imbued with a militaristic tradition, making it a ready ally of the Pentagon. While there are some signs that even the South is moderating

its views on such matters, the principal leadership will have to come from elsewhere. If it does, however, the South will be—as so often has happened in the past when new national policies were established over its strong protests—one of the major beneficiaries. Like McKinley in an earlier day, the South was finally “dragged kicking and screaming into the twentieth century.” Nonetheless, it is now quite possible that the last quarter of the twentieth century will belong to the South. On the other hand, if the rest of the nation follows its present leadership back to the nineteenth century, the South's uneasiness about its new forward direction—born of the nagging remnants of old traditions—could easily lead it to an about-face which would be disastrous for both it and the nation.

Discussion: JAMES G. MADDOX, North Carolina State University

For most of last century and the first three or four decades of this one, the South was the most backward major region in the country. Not only were per capita incomes low but rates of growth were slow. Within the past two or three decades and especially since the mid-1950's, the South has experienced rapid economic development. Per capita incomes are still lower than the average for the nation, and the region is far from having overcome many of its inheritances from the past. Nevertheless, it now appears that the decade of the 1960's may have been an important turning point in southern economic history. The region appears to have joined the mainstream of American life and has been making unusually rapid progress for more than a decade.

The long history of southern backwardness followed by the more recent upsurge of economic activity presents many interesting and challenging problems to students of economic development. What are the factors which account for the early backwardness of the region, and why have we seen such pronounced breaks with past trends in recent years?

In his book, *Southern Tradition and Regional Progress*, Professor Nicholls was mainly concerned with an exploration of factors which in his view were responsible for the slow growth of the South during the century from about 1860 to 1960. In his present paper he focuses attention primarily on some of the important changes that have occurred within the region during recent years.

The basic thesis which underlies Nicholls' work is that traditional values have been important influences shaping sociopolitical attitudes in the South, and that these attitudes in turn led to the development of a set of uniquely southern institutions—laws, customs, forms of political organization, and the distribution of political and economic power—which were barriers to the economic development of the region.

Among the most important barriers to the region's progress, he argued in his earlier work, were such traditions as: the southerner's love of agrarian ways of life; a highly stratified and rigid social structure in the South; a one-party political organization which was dominated by a small upper-class group of whites; and a complex set of laws and customs governing racial relations which greatly limited the opportunities and incentives of Negroes. The present paper is primarily a brief up-dating but to some extent a reassessment of his earlier findings, plus a warning about the imminence of a “new reactionism” which may bring forth a period of social and economic retrogression similar to that which followed the Reconstruction Period after the Civil War.

In those parts of his paper which are primarily concerned with recent changes in the South, Professor Nicholls notes the rapid rates of growth in manufacturing employment, in investment in new plants and equipment, in per capita income, and in a few other indices of growth which have characterized the South in

recent years. This period of rapid growth was made possible, he argues, because the "dominant forces" in the South, "chose progress over tradition." He points especially: (1) to the decline of agrarian values and the impacts which this has had on southern attitudes toward industrialization, and the causes of poverty; (2) to a weakening in the rigidity of the South's social structure and to the growing influence of a southern middle class; (3) to basic improvements in the South's political structure through Supreme Court decisions and federal Civil Rights legislation which have greatly enhanced the freedom of action and political influence of southern Negroes and through legislative reapportionment which has significantly strengthened the political muscle of the urban electorate; and (4) to slowly rising attitudes of social responsibility on the part of the new urban industrial-commercial class.

His description of changes in traditional values, of the impacts which these had on sociopolitical attitudes, and of the ways in which these attitudes have influenced, and been influenced by, legislation, court decisions, and the views of public leaders reflects keen and constructive insights into some of the most important changes that have been occurring in the South. In focusing primary attention on these kinds of changes, he makes a contribution of value to understanding southern development.

There is, however, an important missing link in his major thesis. He fails to provide an explicit connection between the changes in sociopolitical attitudes and the rapid rate of economic progress which the South has experienced in recent years. For incomes to have increased as rapidly as they have in the South in recent years, there must have come into being countless new production functions and significant reallocations of productive resources. We need much more explicit explanations of how these are related to changes in southern traditions and attitudes than is given by Nicholls. Have the changes described by him had major impacts on improving the quality of the southern labor force by raising the level of education of workers, by widening their range of skills, by increasing their incentives, and by expanding their range of social experiences, and, if so, have such improvements been of significance in explaining why the increases in per capita incomes

in the South in recent years have been more rapid than in other regions? Alternatively, have the inflows of capital, managerial talent, and technology from other regions provided the major stimulus to economic growth in the South? These are but two examples of a large number of questions about southern economic development which merit careful research studies.

Some of the changes in the sociopolitical environment described by Nicholls plus technological changes in agriculture and great improvements in transportation facilities have put many types of firms in the South in more direct competition with their counterparts in other regions than was true a few decades ago. The significant challenge in the years ahead may well be in the South's ability to compete successfully with other regions in the growing number of high-technology manufacturing industries and in those types of service industries which cater to relatively affluent consumers.

To meet this type of competition successfully, the South not only needs a better educated and more highly skilled labor force, but it also needs an educational, social, political, and cultural environment which is attractive to highly educated scientists, managers, and entrepreneurs. The eroding away of many of the narrow, individualistic, intolerant, provincial attitudes of the past, as noted by Nicholls, may be of greater importance in the future than has yet been evident in providing a southern environment which is attractive to people with the abilities and talents that are badly needed to increase the productivity of the southern economy. Any threat, therefore, to a continuation of the trends in sociopolitical attitudes which have been clearly evident in the South during the past decade, whether they arise from President Nixon's position on the busing of school children or from other sources, may very well be, as Nicholls suggests, an important threat to continued economic progress in the South. Though there is as yet the lack of firmly established relationships between changes in sociopolitical attitudes and changes in the rate of economic growth, the threat of rising political traditionalism to social and economic progress is too great to be ignored by anyone interested in the continued development of the South.

Discussion: J. J. SPENGLER, Duke University

Professor Nicholls's very interesting revisit to the theme of his important book of 12 years ago presents a discussant with problems. With much of what he has to say I cannot quarrel. So, as a discussant I must select issues on which to differ in interpretation or weighting.

First, I find his argument assigns more power to political agencies, whether presidential or otherwise, than I believe they possess in the domestic sphere. In a democracy this power may represent more than the tip of the iceberg but not a great deal more. This power is essentially catalytic in nature, far more capable of triggering socioeconomic potentials than of creating them. The head of a party is very limited in what he can do, since each of the two major parties is but a coalition of state organizations (or of some state organizations and ideological bodies as in the case of today's Democratic Party) moving temporarily abreast each four years in the hope of winning spoils for themselves, their current following, and their paymasters. Only in the realm of foreign affairs has the chief executive a great deal of autonomy as when the Kennedy-Johnson Administration committed the nation, its lives, and its billions to Asia's jungles. What I am saying, therefore, is that we need to look deeper for the springs of change than to the occupants of the White House. We cannot count upon them to produce a great deal of change.

Second, and before looking at these springs, I would like to say a word for the South's sense of history, even though, as Walter Webb remarked in the very year that Professor Nicholls's book appeared, "the South's history gets in the way of its progress." It did this by affording an excuse for the South's laggardness, an excuse that had some support in the fact that real agricultural income per worker grew not at all between 1839 and 1879 and only 0.3 percent per year between 1839 and 1899, less than one-fourth of the national rate, according to R. W. Fogel and J. Rutner. Responsible were conditions peculiar to the South. We do, however, live in a world subject to a very high rate of technological change generative of discontinuity between components of an individual's life as well as between generations. In an ahistorical age such as the present there may be too little social and ideological cement to hold a society's components together. A sense of history can therefore help create this cement and thus

strengthen the community against self-centeredness and the phony elite currently promoting what Wildavsky calls "the revolt against the masses." Historical amnesia is not a reliable source of social therapy.

Something may be said also in favor of the "Southern mind," recently shown by J. S. Reed to be "enduring" despite allegations that "you can't eat magnolias." Attachment to local community, to what Reed calls "homogeneous Protestantism," and to spiritual values generally, remains stronger in the South than elsewhere and therefore lends support to the opinion of those who believe the South has greater eudaemonistic as well as economic potential than much of the non-South.

Turning now to education, it is worth recalling how inadequate the provisions for education were in the South in the 1920's and 1930's, especially for Negroes, with the result that the ghetto became Jim Crow's revenge. Worth recalling also is the fact that the resources-short South then received little help from the federal government even though millions of Southern children were destined to migrate to the richer North or West. Negroes were at a double disadvantage with limited access to requisite training and, given such training, with limited access to opportunities to use it. Their situation was inferior to that of European immigrants and their children in 1890-1910, for, as Greer shows in *The Great School Legend*, though many of the latter did badly and/or dropped out of school, they could find employment in low-paying, labor-oriented activities. Then, brawn counted for a great deal, but now, with brain ascendant over brawn and with job requirements much higher, the outlet of the 1890's hardly exists. As a result of the combined effect of initial disadvantage and discrimination, the fraction of the Negro labor force in professional, administrative, and other superior employment categories remains very much below the fraction which the Negro labor force constitutes of the total labor force. Elevation of the median number of years of school completed, still about two years below the white average in the South among those 25 and over, is essential to equalization of opportunity.

Mere parity in years of school completed will no more suffice to equalize opportunity than will such often symbolic actions as enforced busing; performance in school is conditioned by

home and environmental factors as well. The net effect of busing depends on concrete circumstances. We still require scientific cost-benefit studies of busing under various conditions—studies which I am sure would reveal adverse as well as beneficial effects. Several important courses of action are indicated. First, in respect to education blacks need to place much greater emphasis upon professional and administrative training and upon employment entailing a high degree of personal responsibility. Second, advantage must be taken of the fact that ours has increasingly become a Mal-functioning Service Economy, operated by administrators, trade-union bosses, and workmen, who as a group seem relatively devoid of the instinct of workmanship and of the desire to serve effectively. If the blacks acquire this instinct of workmanship and the associated desire to serve effectively, especially in the many areas demonstrably immune to salutary computerization, they will have acquired a great comparative advantage.

Professor Nicholls correctly points to black spots in the nation's as well as in the South's immediate prospect. The outcome in the South depends on the nature and the adequacy of the employment developed, together with the degree to which the natural amenities can be preserved and the cultural amenities can be developed. The main thrust will have to be supplied by private entrepreneurs as it has been since 1937 when the New York Trust Company *Index* described the outlook as promising though subject to constraints protective of the South's natural advantages. The force of this thrust, in an age stressing sophisticated products and service, will turn on the degree to which the South's labor force, black and white, is formed in keeping with the emerging composition of aggregate demand.

The South's capacity to attract as well as generate enterprise is very much conditioned by the degree to which it can supply natural as

well as cultural amenities, so valuable in an age of discretionary time and income. Fortunately the South, along with much of the country lying between the Mississippi and the Pacific region, has not yet given hostage to an anomie-ridden megalopolitanized society though some elements in the South seem bent upon doing this. Population per square mile is below 100 in all but three Southern states and there are but 14 cities of over 300,000 among 46 over 100,000; hence, population density within cities remains relatively low. It is still possible, therefore, by encouraging the establishment of additional cities *de novo* or on the foundation of presently small communities to avoid agglomerations of ungovernable size and create private centers capable of attracting modern collections of activities. A great deal of urban planning will be essential, however, if the uglifying amenities-destroying sequences of decisions now set in motion by fast-buck operators, are to be prevented. Appropriate land-taxation and public ownership of land within and surrounding cities are essential. Desirable also is attention at the state level to the facilitation at largely private cost of the occasional supply of cultural amenities now available in very large cities.

There is need in the South for associations of public-oriented businessmen, educators, and publicists, and so on, such as the L.Q.C. Lamar Society, to focus on how the South can progress economically and yet retain its desirable traditional values. There is need also for a Southern Regional and Urban Studies Center to be devoted to inquiring into the development of urban, transport, and associated planning designed to convert the South into the urban society of tomorrow, one embracing Danzig's *Compact City*, Spilhaus's model city, new towns, and other attractive as well as economic arrangements. Then the objective of the city as defined by Aristotle, namely the *good life*, may be realized and escapes provided for the stranded, usually poor rural population.

Seminar Session 1.0

AGRICULTURAL PRODUCTIVITY AND ENVIRONMENTAL QUALITY

CHAIRMAN: MAX R. LANGHAM, UNIVERSITY OF FLORIDA

Agricultural Productivity, Technology, and Environmental Quality*

J. CHARLES HEADLEY

PROVIDING FOR human needs with limited resources requires the efficient organization of production and an equitable system of distribution. These issues have been the central concern of economics. In the early history of economics scholars concerned themselves with trade, the organization of markets, and the development of a political system compatible with a world of mercantilism and men with new-found freedom. For neoclassical economists faced with industrialization, the answer to problems of distribution seemed to be efficient production and Pareto optimality—in other words, more for everyone. As material living standards and population densities increased, the problem of pollution or garbage management emerged. There is still the problem of providing for the world's population through increased production of goods and services, while at the same time there is much concern that our production will generate waste products in such abundance that the quality of life and maybe even life itself may be diminished. Thus, Ruttan [21] noted two challenges to man: providing adequate sustenance and managing the production and distribution of garbage. It is not my purpose to show that agriculture is ecologically sick. However, there are, it seems, a number of environmental problems related to the pressure for productivity and the resulting adoption of industrial products and techniques that require our attention as agricultural economists.

I have characterized these problems as technical externalities, estimation of the costs and benefits of technology, economic growth, and

property rights, each of which will be discussed in turn.

We need not review the dramatic increases that have been made in increasing the output of American agriculture. There is no need to develop a long theoretical explanation for the phenomenon of technological advance that has made this increased output possible while using fewer market-valued resources per unit of output. We are concerned here with the unresolved relationships between technology, productivity, and quality of life. We can and should be concerned because agriculture continues to be plagued with excess capacity to produce, low prices, and, for many, inadequate incomes. In addition, the appropriate use of technology to deal with the price and income problem has come under criticism of late. Fertilizer use has become suspect as a possible source of nitrates in streams and underground water supplies. Concentrated animal fattening plants have been charged with pollution of water and air. Intensive cultivation has been criticized for its contribution to sedimentation problems as well as the alteration of landscape through removal of natural vegetation. Finally, chemical pesticide use has been seriously attacked for the discharge of toxic chemicals into the environment, allegedly damaging wildlife, fish, domestic animals, and humans. So, while providing an adequate supply of food and maintaining the income of farmers have been challenging enough for as long as I can remember, there is now the additional challenge of finding and maintaining the right relationship between agriculture and the natural environment.

Technical Externalities and Resource Use

The study of environmental quality and its relationship to technology and productivity brings us face to face with the issues and problems of economic welfare theory. Even if the problems of wealth and output distribution, which loom quite large, are assumed away, the

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problem of technical externalities remains. The interdependency of production functions and the spillovers from consumption activities are physical realities that confront us in almost any economic problem we can imagine. However, it is only since the increase in the furor over environmental quality that economists have given much thought to this phenomenon.¹

With respect to agriculture and its role in environmental problems, there seem to be at least three main questions of interest to economists. First, are the demands that modern agriculture places on environmental resources in the public interest? Second, does the total bundle of resources now used by agriculture represent the least social cost use of national resources? Third, is increased productivity in agriculture and the associated economic growth consistent with improved welfare?

If the answers to the previous questions are in the negative, there is reason to believe that the external costs of agriculture are much larger than we had thought since most of our statistics and research results show that the public, through the market, has fared reasonably well under policies stressing technology, increased productivity, and growth. For instance, the real (market) price of food, excluding marketing services, is now estimated to be about one third of its level in 1929 [10]. These studies conclude that the consumer has benefited from increased productivity in agriculture through low cost food and fiber.

Paraphrasing Barry Commoner and his colleagues [11], agriculture has not been using the least cost bundle of resources but rather has been tricked into believing in a statistical measure of efficiency that leaves unaccounted resources that many believe are of great value. The consumer's price does not reflect the opportunity costs of the environmental resources incorporated in food production. This line of argument suggests that the resource savings we believe to have achieved have not been savings at all but substitution; that inputs such as fertilizer are underpriced because the external costs of use, such as possible nitrate pollution, are not accounted; or that the external costs of nitrogen production are not accounted, since nitrogen output is a by-product of petroleum production which is itself not being used at an optimal rate. To summarize, Commoner would

seem to argue that a proper accounting system including the external cost of environmental resources would show agriculture to be less efficient than we believe it to be. If these observations accurately reflect the scientific facts and our values, our agricultural strategy with respect to growth and development will need to be rethought.

Of course, the painful truth is that no one knows whether Commoner is right or wrong. This statement in itself tells us something about ourselves and about the kind of economic policy we have been using in agriculture. There was a reason why we were not required to understand technical externalities in graduate school. They were not important! When operating under a philosophy of expansion by exploitation, the use of the environment as a disposal medium for the residuals of production and consumption is not important because, for a time at least, the quantity of environmental resource services demanded does not exceed the quantity available. It appears now that the demand for the services of the environment has expanded both for use in disposal of production residuals and for consumption as amenities, the latter believed to be quite income elastic, such that the distribution of common property resources has become a problem.

The questions posed earlier in this section concerning whether agriculture's use of the environment is in the public interest and whether output was being produced at the lowest social cost are difficult questions to answer. The difficulty arises because of a lack of information relative to the demands agriculture is placing on environmental services as well as a lack of definition of what constitutes the public interest and therefore lowest social cost. This information is not available because of gaps in physical, biological, and social information. Many of the processes allegedly at work are not well understood, and the proper measurements have not been made to allow estimation of environmental parameters. In addition, we are poorly informed about the optimal levels of certain technical inputs such as pesticides, partly because their use has been so obviously profitable to the firm in the short run [9]. Thus, little attention has been paid to their use rates. We have no objective way of knowing whether farmers are applying equilibrium amounts,²

¹ Good expositions of the concept of externalities are found in Meade [16], Castle [7], and Buchanan and Stubblebine [5].

² Recent research by Ogut [18] has concluded that Missouri farmers are not overapplying nitrogen fertilizer to corn in relation to the prices of corn and fertilizer. This study was not able to judge the social optimality of nitrogen use due to the reasons mentioned above.

whether the same or better results might be achieved with less input of pesticides, or whether there may in fact be better methods of dealing with the problem.

With regard to use rates of insecticides, some interesting research is under way by entomologists to see if chemical insecticides integrated with biological and cultural controls and good farm management can profitably reduce (not necessarily eliminate) the use of insecticides. Adkisson [1] reports that in west Texas, with supervised insect control procedures, cotton was produced on the Pecos Experiment Station from 1968 to 1970 with only one insecticide treatment, providing yields of lint cotton comparable to farms adjoining the station and throughout the county where 8 to 10 treatments per year were used. Adkisson also reported that farmers were using much too much insecticide for treatment of greenbugs on grain sorghum near Lubbock. They found that 0.1 pounds of parathion per acre gave 98 percent control after 3 days, compared to 100 percent control with 0.5 pounds per acre.³ After 7 days the percent control was 93 and 97, respectively. In Adkisson's opinion insecticide control on cotton in most areas of the U. S. might be reduced by as much as 50 percent without reduction in yields.⁴ This particular example points up the need to provide the users of technology with better information than they now have and the need to communicate effectively with them.

Where nitrate pollution of water supplies is a problem, it is evident that experiment station scientists are not well informed concerning the fate of nitrates in the soil. It has been estimated that 50 percent of the nitrates in Lake Decatur in Illinois were from farm fertilizer sources [14]. Agronomists, to my knowledge, do not know how general that result might be. We do not know how soil type, type of farming, time of application, and other variables might affect the amount of nitrate that reaches streams and underground water supplies from a given application. Until this kind of information is available, policies to control nitrogen use will be made under a considerable amount of uncertainty.

The challenge presented to agricultural economics research, teaching, and extension with regard to the allocation and distribution of en-

vironmental resources is indeed large. We have not developed our research to deal with these kinds of questions. Our students are painfully ignorant of the theoretical concepts of public goods, common property resources, collective goods, option demand, and the general theory of welfare economics. Our extension work has tended to focus too much, until recently, on the economics of the firm with the tacit assumption that interdependencies of all kinds, including third party effects, were either nonexistent or unimportant. Much relevant work therefore remains to be done. It seems clear to me that agricultural economists must become involved in research designed to provide answers to these questions.

Estimation of the Benefits and Costs of Technology

Benefits from technology arise principally in two forms: either the new state of the arts saves resources or it provides a larger output from a given resource commitment. In principle it seems rather straightforward to estimate the total resource costs before the infusion of new knowledge and then estimate the resource costs, given an output level after the innovation with the difference representing the resource saving. Or, alternatively, one can estimate the equilibrium output prior to the new knowledge and again afterward with the incremental increase in output representing the output gain made possible by the advance.

While the above procedure is straightforward, it is also oversimplified. Infusion of new knowledge into the economic system is a dynamic process. Change, rather than being an instantaneous transformation, is a series of events and developments with linkages through time. Therefore, there are difficulties in classifying benefits and costs. We are all familiar with the transformation of the benefits for one generation into the costs of the following generation. Similarly, one change in the state of the arts occasions another and the individual benefits are not additive lest multiple counting occur. Therefore, the evaluation of technology must consider more than the instantaneous effects. Cotton entomologists are convinced that our chemical solutions to boll weevil control have induced the bollworm problem. With the development of insecticide resistance by the weevil, cotton growers today have two problems.

We are now more than ever faced with a holistic approach to analysis of our activities. We are thus interested in all benefits and costs,

³ In a personal conversation Adkisson stated that the extension service was having difficulty convincing farmers of this fact.

⁴ This opinion is consistent with the opinion of the President's Science Advisory Committee [19] in 1965.

that is, the social costs and benefits of our activities. This is the essence of economics applied to environmental problems. All resources employed must be accounted and all of the benefits must be estimated, hence, the problem of defining the resources to be saved and the outputs to be increased. For most significant developments this requires considerable understanding of the system before, during, and after the infusion of new knowledge.

If you will pardon a Corn Belt example, the culture of continuous corn will serve to illustrate the evaluation problems. The advent of commercial nitrogen made it possible to produce continuous corn without reductions in yield. Farmers then began to produce corn without benefit of legumes in the rotation, but problems began to appear. Continuous corn production developed disease, weed, and soil insect problems requiring the application of various chemicals as complements to commercial nitrogen. To assess the contribution of commercial nitrogen to corn production, we must be sure to measure the net contribution and not the gross, that is, net not only of the factor cost of the nitrogen, but net also of the other inputs that are required along with nitrogen. While I am neither an entomologist nor a plant pathologist, I feel certain that most of the current disease and insect problems of corn culture have been induced by the practice of continuous corn. Thus, the cost of developing new control devices is a cost of continuous corn.

The evaluation process can be taken further. Changes in corn production may have also precipitated some of our nitrate problems as well as pollution problems from mercuric fungicides and chlorinated hydrocarbon insecticides. These are costs if proven to be serious—and I believe this to be an open question—that must also be netted out of the contribution of commercial nitrogen to corn production.

Of course, the process is also capable of branching, since one can separate the pest control aspects of corn production and evaluate them as well. Taking as given that continuous corn production is the optimal practice, we can ask what the contribution of insect control is to farm income. If one cultural practice induces another problem, then clearly the cost of solving the induced problem is a cost of the prior practice. Prevention of damage from soil insects induced by continuous corn is a non-trivial problem and a benefit to be compared with the cost of insect control only so long as

the practice of continuous corn is clearly superior to other methods of corn production. The approach is partial or incremental, and the quality of the result is only as good as the choice of values from which the partial analysis proceeds. If the givens are not correctly chosen, we can become guilty of what Boulding [4] has characterized as doing a very good job on things that should not be done at all.

There are, in my view, many developments that need to be made in the evaluation of our technological strategies throughout society. Our methods are myopic and so is our advice. There are great challenges for the young in our profession to develop the analytical skills that will provide alternative technological strategies for agriculture that are not the product of Topsy-like processes but rather contribute by design to the fulfillment of the aspirations of society.

Economic Growth, Technology, and Environmental Quality

It has been suggested that in order to combat the current and prospective environmental quality problems there must be more economic growth. The argument goes on to assert that there is no way to marshal the resources necessary to correct pollution and other forms of degradation with a static GNP, since environmental improvement is analogous to and competitive with activities such as health and education and must find the needed capital in some sort of surplus over and above current patterns of consumption and investment.

E. J. Mishan [17] in an exhortative article, rather out of character for most professional economists, suggests five reasons why this argument is wrong. First, Mishan argues that the industrial growth of the last 20 years creates much more pollution than is eliminated by private and public spending and more of the same appears to be in store. Second, pollution abatement increases rather than diminishes real GNP. Third, too little of the annual increment to GNP is committed to combating pollution. Fourth, the need for more GNP to accomplish environmental improvement is fantasy because each year more and more GNP goes toward items that are, in Mishan's language, "near garbage" and "positively inimical." Fifth, expenditure is not the real need. Rather, what is needed is effective legislation to put the burden on the polluter and real-

locate resources away from pollution-creating goods.

While the arguments of Mishan along with those of Scitovsky [23], Boulding [3], and Galbraith [8] smell strongly of value superimposition, they point to a question we are not prepared to answer. Can the quality of life be improved given a static metric such as GNP? Or is a rising GNP necessary for improvement of the quality of life? Or should we find another measure? Staffan Linder [15], in his economic analysis of time as a resource, provides some intriguing ideas. His thesis is that economic growth increases productivity, thereby increasing the yield on time. When this occurs, there is a disruption of the time-return equilibrium existing under the previous income level and all uses of time must be adjusted to bring the time yield on all activities up to that of working time. Linder therefore concludes that economic growth leads to a general scarcity of time. Moreover, as growth of goods increases and time becomes even more valuable, the resulting affluence is only partial and life becomes harried.

Resource allocation in agriculture has been considered an important variable in the strategy for economic growth. The conventional wisdom has been that only when productivity in food production was high enough to release agricultural labor for other tasks could real growth take place. Naturally the term growth is usually synonymous with industrial growth and is also value laden. Industrialization leads to mechanization, more consumption of goods, and a general substitution of capital for labor. But consumption requires time and must be at least as rewarding as production. Consequently, following Linder, society moves toward ways of increasing the yield on consumption time by finding quicker ways to eat, exercise, be entertained, etc., all of which can lead to an overwhelmed kind of life in the midst of material affluence.

Agriculture is certainly not responsible for increasing the tempo of life under a policy of growth, but the agriculture we know is the result of growth-stimulating policies. However, agriculture has not shared in the product of growth on a par with other sectors. Farm incomes continue to lag, rural poverty continues, and rural communities have fallen behind in community services in spite of higher taxes. As the population becomes well fed, income elasticities of demand for food decline. Consumers are

willing to spend relatively more on marketing services to save time than on the basic food itself. Finally, we find that agriculture is expected to provide food at a price which will leave the largest residual to indulge in demands for the luxuries of modern life.

Adoption of industrialized technology is the method we have chosen to minimize the market value of resources devoted to agriculture. In that regard we have been effective. But the extra-market values sacrificed for cheap food and economic growth have not been as consciously economized, if at all. Our streams and lakes are muddy and contain a variety of man-made chemicals. Our groundwater is suspect and the disposal of animal and processing wastes in certain localities impinges upon the natural environment in an unsatisfying way. Communities have been depleted of their people as economic growth has spurred urbanization. At least part of our economic growth has been provided by living off the depreciation of both the countryside and the cities. Yet due to our method of measuring our material well-being, the maintenance activities required to correct the former short-sightedness result in increasing GNP [4].

Political candidates speak of attacking these problems and many ask the source of the resources to replace the depreciation. The easy answer is continued economic growth because it holds the promise of no apparent material sacrifice. But, that is an empty promise for growth of the type we have known. It seems clear that the twentieth century brand of economic growth based on technology and industrialization is, if not the cause, at least central to the issues of the quality of the environment. The political or ideological base is not easily indicted since the countries of the Soviet Bloc are also experiencing similar problems. The resources to replace our natural and social depreciation will come at least in part from our present and future consumption if the problem is to be resolved.⁵ Making this a reality will require some very far-reaching changes in our attitudes and our basic philosophy involving patterns of consumption, the institution of property, and taxation. Therefore, I agree with Ruttan [21] concerning the sociopolitical as-

⁵ This obviously represents a deep commitment on my part to an old economic adage supported by a basic Teutonic outlook that there is no such thing as a free lunch.

pects of the environmental controversy. There is much work to be done in our nation. Yet, unemployment is a perennial problem. It is a problem of equity and distribution. Who will sacrifice? Who counts?

Property Rights and the Environment

Various authors have cited the importance of property rights in matters of environmental degradation and improvement.⁶ Many of our environmental conflicts arise as a result of increased demands for common property resources. When the assimilative capacity of the resources has been reached, congestion (pollution) sets in and the resource is no longer free. Rationing then becomes necessary and/or decisions must be made regarding expansion of capacity.

Solutions to this kind of problem would seem to be forthcoming from analysis by standard resource allocation techniques, hence, the various articles and books on taxes and subsidies as a means of restoring efficient resource allocation where common property resources are concerned [13]. Without intending to be hypercritical, this work, while interesting and capably done, misses the point. For it is one thing to determine the damage from animal wastes discharged into a stream and yet another to decide who should pay. Should the feeder pay to discharge or should the public pay the feeder to refrain from discharging? For questions such as this efficiency analysis is premature, since in many cases the property rights have not been defined and we can not determine who is imposing on whom.

The first question to be answered in this case is the one that indicates who counts, the feeder or the public stream users. That decision should, under our form of government, be a collective decision since it vests some group with property rights. Once that decision has been made, following Buchanan and Stubblebine [5], the relevant externalities can be identified and economically efficient means found to internalize them.

Granting of property rights is a serious business, with far-reaching welfare implications, for the granting determines who can buy and sell, what markets will exist, and how the product of the system will be distributed. The most im-

portant consideration in granting property rights is the determination of the kind of performance that is expected of the economy.

Therefore, some of the questions we need to be asking are: what form of property rights will provide us with the kind of use of our natural resources that is most consistent with our social goals? How will changes in property rights affect various groups within society? What effect will different kinds of property rights have on technology? How will markets be affected? Will indemnification be required?

It seems these are relevant questions that, when answered, will eliminate much of the confusion that surrounds the use of the natural environment, the choice of technology, and the brand of economic growth. The collective decision to vest in certain groups the right to prescribe and apply pest control methods in agriculture can remove considerable controversy and uncertainty and, in addition, lead to better results. As long as each producer is given the right to buy and use whatever is for sale, the available methods should be restricted to those that can be safely used by non-experts. It is clear from historical experience that a market solution within our present institutional setting will not provide a desirable solution for pest control. If it is decided that the public holds all the property rights to navigable streams and that the public value of these streams will be maximized by multiple uses including recreation, water supply, navigation, and waste disposal, then the public can exchange the rights for money through use permits for the various activities. At this point the water pollution problem is amenable to economic analysis of the kind with which we are most familiar. I am not suggesting, nor do I intend to suggest, that market solutions have no place in environmental quality problems. Rather, I am convinced that given present institutions, attitudes, the vagueness of certain property rights, and high transaction costs, market solutions will never be effective since there are too many barriers to trade. Therefore, policy makers will resort to the one method that is most available—standards and regulation—unless they are provided with superior workable alternatives [20].

Future Directions

Having outlined what I feel are the major problems we face as we try to maintain agricultural productivity, use technology to ex-

⁶ See Allen Schmid [22] for a fine discussion of property rights and environmental quality issues.

pand our resources, and provide a fulfilling environmental dimension to life in our society, it is appropriate to speculate on the directions we may take in our attempts to serve the public as researchers and educators. It is my personal view that we as professional economists are fortunate to have before us the challenge to assist in the development of strategies for moving our society into a new era. There is no shortage of work to do.

We have turned the corner in our search for a place for the applied talents of agricultural economists in dealing with the problems of contemporary society. Now these talents must be organized to press on with the work [12]. Gone or at least weakened are the kinds of frustrations that gave rise to Bonnen's [2] concern for the decadence of the agricultural establishment and the restrictions it placed on the experiment station. We can now and in the future work with problems outside the usual definition of commercial agriculture without apology or fear of reprisal.

I have already indicated some of the tasks that lie before us: (a) development of our understanding of externalities and assessment of the set of coefficients that relate agriculture to the natural resource base, (b) improvement in our methods of estimating the benefits and costs of technological change using a holistic or systems approach, (c) the need to develop a more complete explanation of economic growth and its relation to use of environmental resources, and (d) the need to explore the consequences of alternative sets of property rights and accompanying institutions to make the problem of defining goals and analyzing alternative methods of attaining objectives manageable. There is also the need to become more closely related with other disciplines that are likewise concerned with the two challenges mentioned at the outset.

Having broken away from the confinement to problems of commercial agriculture and the declining constituency it represents, we are now in a position to focus on problems of the rural or at least non-urban community. These are problems that do not fall neatly into our usual boxes of academic interest [24]. Problems of the disposal of human and animal waste require the cooperation of several areas of expertise to develop acceptable and workable solutions. The working out of strategies for pest control will require the biological, chemical, engineering, and social science resources of our

experiment stations and government agencies. Adaptation of agriculture and our entire system to the ever-increasing pressure on energy sources will demand the concerted skill and imagination of us all as we try to find ways to bring about social and technical change to adapt to new resource problems.

What of the future of the discipline and the core of economic theory and methods that bind us together? There is the fear that our engagement in multidisciplinary endeavors will weaken our need for and command of our basic discipline. Johnson [12] very skillfully dealt with this question and argued that such activities will show the need for more rather than less disciplinary training.

One fairly common complaint is that the questions addressed here are very messy and of the type that welfare economics has addressed but has been unsuccessful in answering. It is then easy to say that welfare economics is useless and return to work on problems we can solve. This is not the appropriate response in my view, for we must admit that welfare theory at least lets us ask some of the right questions. When compared with other disciplines, we are considerably advanced in our approach to these problems. Economists should not shrink from the challenge. We have a history of at least 200 years that documents the thoughts of people wrestling with the problems of equity and distribution from Adam Smith to Kenneth Arrow. Because the theory of welfare economics and its empirical application is not up to our standards of neatness indicates that it should receive more emphasis rather than less.

Whether all of our present academic baggage will remain as we relate to other disciplines is of course another question, but my experience in working with another discipline on pest control problems supports Johnson's thesis. I have found optimization concepts, capital theory, and other concepts that are a part of the way economists think to be highly useful in trying to make sense out of pest control problems and have found the problems demanding of economic skills. It seems certain that the working out of a nitrogen policy, the development of methods of dealing with animal wastes, and their evaluation, for instance, will require the best in theoretical and quantitative skills if we are to do more than just "wool" the problems around. The work of Burt and Cummings [6], for example, has demonstrated the complexity of dynamic investment processes that are most

assuredly a part of the intertemporal allocation of resources.

Finally, I believe that the future holds some exciting prospects for agricultural policy. Now that we have acknowledged the pervasive interdependencies that exist between agriculture and the rest of the economy, I believe we can look for a movement away from what has been, for me at least, a dreary patchwork of commodity programs and marketing schemes that has turned the study of economic policy for agriculture into an intellectual wasteland. A holistic approach to meeting the agricultural needs of a society that is keenly aware of a complex set of resource constraints will and must lead to more recognition of the relationship between institutions and technology and the recognition that programs alter production functions as

well as reallocate along existing ones. What we are learning as we attempt, through simulation, to build holistic models that incorporate large numbers of technical and behavioral relations in addition to our increasing multidisciplinary experience should be helpful in the planning of agricultural activities to indicate the direction of various kinds of policy decisions.

These are exciting times. I believe that we will witness, before the end of this century, some of the most dramatic changes in the organization of resources to meet the needs of man since the beginning of the industrial revolution. Agricultural economists can be a part of shaping that change if we develop our intellectual curiosity and renew our dedication to the solution of the problems of people.

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Discussion: ARLO W. BIERE, Kansas State University

Dr. Headley's paper is more general than the program indicates. He primarily focuses on general concepts rather than on specific aspects of agricultural technology and environment. However, he presents a well-developed discussion of several issues, particularly pesticides and continuous corn production. His analysis of technical change in corn production is especially enlightening. If additional technology is required to treat side effects of a new technique, then the cost of that additional development should be charged against the technique itself. But the economic feasibility of the induced development can be evaluated independently of the former, which indeed is the correct approach when the system is in equilibrium before the initial change is introduced. If the old technique does not produce a stable natural environment, changes in the natural environment associated with the old technique must be accounted for in the constant technology situation.

Although Owens and Griffin [6] and others have made a significant contribution to the analysis of animal waste management and have pointed out informational needs, Headley does not discuss that problem. Soluble pollutants transported via percolating water from feedlot and disposal area to the groundwater reservoir are especially critical. From the aesthetic, "public nuisance," and animal health standpoint, good manure management apparently results in the worst subsurface contamination [5]. The apparent advantage regions low in rainfall have in terms of waste management is somewhat counteracted by the increased potential for subsurface pollution because the coarser soils which predominate in these regions are more conducive to deep percolation of surface waters. A thorough analysis of the regional impact of animal waste management would be useful both to the livestock industry and to public policy makers. Those who assert that the cost of waste management is or will be borne wholly by the livestock industry fail to account for long-run adjustments, which eventually force packers to pay higher prices and to pass most, if not all, their added cost to the consumer. Finally, the combined impact of the DES banning and of controlling animal waste could necessitate the search for totally new systems of livestock production. What, for example, would happen if the use of antibiotics in livestock rations were prohibited?

The major topics of Headley's paper—technical externalities, social costs and benefits, economic growth, and property rights—are not new to resource economists. I was disappointed not to find in the paper new ideas that could lead to useful introspection of existing approaches. To simulate discussion I have selected four issues that could be considered in evaluating the paper: (1) definition of environmental quality; (2) the concepts of welfare and public interest; (3) role of positive economics in institutional design and evaluation; and (4) implications for our profession.

Environmental quality not only is undefined but is used inconsistently in the paper. In one place the term is synonymous with natural environment; at others it refers to the quality of the human environment. Though interchanging the two concepts is not uncommon, I contend that environmental quality is undefined until the reference organism is defined because the environment is the surrounding space within which an organism interacts. Cries of the Sierra Club notwithstanding, I must conclude that man is the reference organism when considering environmental quality management. Management involves conscious direction and control. Man is the organism capable of performing such acts; therefore, the environment is managed on the basis of human values, which incidentally may include preserving endangered species. Quality of the natural environment implies maintenance of the "balance of nature," a concept some biologists say does not exist. On the other hand, quality of the human environment receives its constancy from man's relation to the natural environment. The natural environment and man's values continually undergo change, but man and society give us a fixed point from which to analyze environmental quality as a function both of physical attributes of the environment and of the desires of the object interacting with and evaluating that environment. Changes in human values can influence man's assessment of the environment without there being a concomitant change in the environment itself. Improving or maintaining the natural environment is a means to the "higher" end: fulfilling society's desires. Because a synoptic analysis of that means is not possible, we must consider the problem in smaller packages, one of which is quality of the natural environment. Once again the social scientist

and the policy maker are caught on the continuum of ends and means. Although the dilemma is necessary to make analysis feasible, failure to keep referring to the higher ends can, to paraphrase Boulding, "lead one to do things well that ought not be done at all."

The Hatch Act—designed to improve the welfare of farmers by increasing their productivity—illustrates the dilemma of the continuum of ends and means. As it became apparent that increased productivity did not correspond directly with improved farm income, the first instinct of agricultural scientists was, and in many cases still is, to find a new rationale for the intermediate goal rather than to alter that goal. Likewise, adhering to fixed levels of allowable pollution by individual entities can result in increasing pollution because the external effect of increasing density cannot be accounted for. Primary treatment plants constructed for municipal wastes during the Thirties did decrease BOD discharge from municipal outfalls. But as population increased without continued improvement in waste treatment, there was a new surge of municipal pollution. Thus, it becomes a case of chasing after a moving target at least as long as population grows.

Many questions posed by Headley require at least some notion of social welfare or the public interest to be operational. He demonstrates the inadequacy of GNP as a social indicator and notes that the neoclassical economist of recent times has confined his scope to economic efficiency and Pareto optimality. To my disappointment, he does not explore that problem further. Questions posed cannot be answered adequately until we know at least partially the value of non-market service flows and the measure of social welfare. It is not scientifically possible to aggregate individual values to social values. Franklin Fisher [1], on the other hand, indicates that conditions for the existence of aggregate production functions are so strong that they may not exist even as approximations; yet, aggregate production functions cause no problem for most economists. National accounts, especially in measuring real products, are to some extent subjective. Therefore, I do not feel that we should so readily dismiss the possibility of at least approximating the social welfare function. One approach might be to make the aggregation under alternative assumptions and explicitly indicate the assumptions used in the aggregation. Or, we might attempt

to measure the social values as reflected through political institutions and to study political institutions for their ability to transmit information throughout the system.

We have used GNP to measure social welfare when it is not capable of doing so. Social accounts should not only reflect social values but also be able to cope with multiperiod analysis. In the national accounting system capital accumulation indicates the future productive capacity of the economy in terms of man-made capital. The natural environment is also a form of capital since it is capable of producing a range of service flows and of being depreciated. Could we not devise a set of accounts to indicate the continued productive potential of a nation's or the world's natural resources?

From much of the paper I received the impression that economics can be only normative. Headley, for example, dismisses many of the behavioral aspects of technological development. Glen Johnson [4] in a recent article also indicates that the contribution economics can make to prescriptive analysis is normative in nature. I conclude that in many of the policy issues it is possible to use primitive techniques to approximate the desirable outcome. A more difficult problem is to develop the institutions and management techniques to produce the desired outcome. Economics has the unique ability to analyze institutions and their impact on society.

I suggest that the biggest impact technology has had or will have on environmental quality is in increasing man's leisure time and in providing sustenance items cheaply. The result is that man has more time and income to devote to new pursuits. Although certain local environments definitely are declining in quality, on a national scale the change in demand for environmental amenities has probably been as much responsible for the environmental movement as environmental degradation. The demand for environmental amenities soon may be in direct conflict with natural ecology. According to some authorities, that already is true for clear cutting of timber, for example. Recognizing that the biggest hazard to the natural environment is man's basic encroachment on that environment is producing a new national land-use policy.

Headley leaves the impression, "Thank God we found something to do, I thought we had run out of work." If we have no more work, it is because we have lost our creativity and initia-

tive. There are endless policy issues requiring economic research, and policy makers are recognizing that need. On the other hand, we face stronger competition from others—for example, the regional economist and the engineer—in providing such information.

Headley's paper points to research tasks that rely on other disciplines to produce information needed for economic analysis. I do not feel that we will get that information unless agricultural economists take the lead. Georgescu-Roegen [3] has noted that classical economists took great pains to study the operational nature of production processes, but that modern economists are satisfied with a functional relation-

ship. One exception is the engineering economy study by French, Sammet, and Bressler [2]. It seems we are trying to abdicate something that is still at least partly our responsibility. Headley's multidisciplinary work on the productivity of pesticides is an example of the type of contribution that we could be making. My experience with irrigation scheduling and simulation analysis of irrigated crop production leads me to conclude that economics would find it profitable to return to operational analysis of production processes. It is time for the modern economist to rediscover the breadth of interest that was once economics.

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Discussion: JAMES C. HIRTE, Clemson University

Professor Headley has had a very difficult assignment and although he and I might quibble over minor points, I will not attempt a general critique of his paper. Rather, in my comments I will attempt to give the question of agricultural productivity and environmental quality a somewhat different perspective.

It may not be too obvious to begin by recalling that agriculture produced undesirable environmental side effects long before the 20th century revolution in agricultural productivity. The soil erosion which accompanied much of the early cotton and tobacco agriculture of the South caused widespread silting of streams, destroying certain types of aquatic life, increasing the hazards of floods, and changing entire ecosystems. Work animals on farms in the pretractor era produced enormous amounts of waste, and that waste posed a very serious health hazard to farm families and their neighbors in a time when the fly swatter was a very imperfect substitute for pesticides. In this century the Dust Bowl phenomenon of the

1930's was a major environmental problem associated with attempts to cultivate submarginal lands. In fact, technology and the increased agricultural productivity it has engendered have made possible the return of much submarginal and marginal crop land to forest and grass and reduced, if not practically eliminated, many of the kinds of environmental hazards arising from agriculture in the past.

It is an open question, I believe, as to whether or not, on balance, increased agricultural productivity has given rise to more environmental problems than it has solved. Certainly the current environmental problems associated with agriculture are more fugacious than those of the past. Environmental problems which in the past may have plagued only farm families and their neighbors now may surface many miles from the farm in densely populated urban areas or in areas of very fragile natural ecosystems. But we should remember that not all of the current threats to the environment from agriculture are the results of increased

productivity. Agricultural technology has changed the form and place of the threats (and perhaps increased the number of people exposed to these threats), but it did not originate all of the threats. Moreover, it is important to note that not all of the blame for such environmental threats as those posed by pesticide residuals can be fairly placed on agriculture. The public health uses of such pesticides as DDT has been fairly widespread, and chlorinated hydrocarbons found in the tissue of wildlife and bottom samples from streams and estuaries are not exclusively due to the use of pesticides by agriculture.

Professor Headley suggests that the increases in agricultural productivity which have characterized this century (and especially the last 30 years) have been largely in response to pervasive demands which have origins exogenous to the agricultural sector. Although the drive for growth in GNP does influence the agricultural sector in a broad and general way, it may well be that a far more important force has been competitive structure of agricultural production. It is doubtful that farmers adopt new technology simply because they wish to contribute to growth of the GNP. Rather, they adopt this technology because they hope it will increase their profits or at least allow them to keep their costs in line with other producers who have adopted the same technology that Headley states. For example, he states that certain technical inputs such as pesticides have been "obviously profitable to the firm in the short run," when in fact it may be more nearly correct to say that these technical inputs have been necessary for the survival of the firm because of the competitive structure of farming. In a Shumpeterian sense, such profits as were to be reaped from the technical inputs were probably restricted to the early innovators, and later users adopted the technology as a defense. It is difficult to see, therefore, how change in national priorities relative to GNP could have major effects on the adoption of new technology by farmers. If the use of such technology by farmers is to be restricted for environmental reasons, it will probably require outright regulations or prohibitions by government.

It is probably also worthwhile to note that agriculture produces certain positive as well as negative environmental externalities. For example, agriculture can be quite important in maintaining open spaces and producing visual amenities. Policy decisions exogenous to agri-

culture, however, can and do cripple the ability of agriculture to provide these amenities. I am thinking specifically of the practice of taxing agricultural land at its current market value and the effect such taxation has in forcing farmers either to adopt practices which produce very high returns per acre (with possible undesirable environmental side effects) or to sell their land to a developer who will transform the open spaces into shopping centers and rows of tacky houses. There is a trade-off (although admittedly one very difficult to evaluate) between the tax revenues derived from such a taxation policy and the environmental amenities associated with certain types of agriculture on the rural-urban fringe.

As Professor Headley notes in passing, there are some very significant problems of wealth and output distribution associated with the matter of agricultural productivity and environmental quality. It is appropriate to ask who benefits from improvements in environmental quality. Of course, if environmental quality falls below levels safe to human health, we all are damaged, but it would be a remarkable coincidence if we all benefited equally from improvements in the quality of fishing waters or increases in the population and range of the bald eagle. Increased productivity in agriculture probably has the greatest benefit for low-income families who spend a large portion of their budget in food. On the other hand, the limited research I know about suggests that non-health-related environmental amenities are superior goods, that environmental amenities are most strongly desired (in terms of expressed willingness-to-pay) by middle- and upper-income households. It seems quite likely that if we place environmental restrictions on the productivity of agriculture, the damages and benefits will not fall on the same socioeconomic groups. Lower income families will pay more for food in order to achieve environmental amenities for which they are willing to sacrifice voluntarily very little just in order that their more affluent neighbors will be able to enjoy these amenities. In fact, if we assume a growing world population, these environmental restrictions which limit agricultural productivity will not simply place an extra burden on the food budgets of low-income families, they may actually induce significant increases in worldwide starvation and malnutrition. Given worldwide population control within the context of welfare economics, it may be possible for those

who gain from the environmental amenities preserved or increased by restrictions on agricultural productivity to compensate the losers, but no one has apparently given very much thought to the institutional requirements for achieving such compensation.

Researchers in agricultural colleges have sometimes failed to accept the fact that the short-run interests of farmers may conflict with broader social interests. We have construed our mission to be "service to agriculture" when, in fact, our salaries and to a large extent our research projects are funded by taxes collected from all of society, not just farmers. Agricultural economists especially have training which should give them a broader perspective that should help them to understand the possible conflicts between the short-run interests of farmers in particular, the agricultural establishment in general, and the interests of consumers and society at large. It may well be that, at least in some departments, graduate students are not exposed to the concepts of

externalities and welfare economics. Professor Headley is right in stressing the need to train a new generation of agricultural economists in headier stuff than the theory of the firm. But "service to agriculture" is an engrained tradition which is reinforced by the need of deans and administrators to cultivate a political constituency among farm groups. Regardless of his training, the agricultural economist who construes his mission to be "service to the public through agriculture" may find himself in conflict with this political constituency and ostracized by the agricultural establishment. So, while I have great confidence in the pragmatism and competence for empirical research of agricultural economists, I am pessimistic about the profession's ability to contribute significantly to objective economic evaluation of the trade-offs between agricultural productivity and environmental quality. It is a problem area which will require the attention of the mavericks among us who are both competent and masochistic.

Discussion: HERBERT H. STOEVENER, Oregon State University

Professor Headley has presented us with a good discussion, and most of us find little basic disagreement with him. The topic of his paper is very broad and difficult to treat. He has given us a very readable paper, and his insights into the topic are reflected both in the paper's organization and in its content.

I read Headley's paper mainly as a summary of the state of the art of agricultural economists' professional activities in this area and as some general directions for their future efforts. In attempting to summarize his thoughts for this group, I noticed that Headley had used a communication model which seems to have gained in popularity among major speakers at this Association's annual meetings. I call it the "give them hell, but not without hope" model. Thus, with respect to technological¹ external-

ities, we are made painfully aware that we really do not know whether Commoner is right or wrong. With regard to the estimation of the benefits and costs of technology, we are told, "Our methods are myopic and so is our advice." On the subject of the relationships between economic growth, technology, and environmental quality, we get what we deserve for our reliance on GNP as a social indicator and for our inability to produce a better one. Finally, with regard to property rights and the environment, we are reminded of the fact that we know very little about the consequences of alternative institutional arrangements for managing environmental quality.

But we are turning the corner. It is perhaps a minor point, but I wish Headley's analysis had made our profession's future productivity less dependent upon our alleged break with the confinement to problems of commercial agriculture. It is not entirely clear which constraints he thinks have been released. Certainly some new ones are being imposed. In my judgment, more evidence will need to be collected before

¹ The term "technological externalities" may be preferable to Headley's use of "technical externalities" for the phenomenon which he is discussing. It may avoid confusion with Bator's [1] classification of externalities in which the term "technical externalities" is reserved for the special case of indivisibilities and increasing returns to scale.

the impact of the rapidly changing administrative constraints under which university-based agricultural economists operate can be fully evaluated. I agree, however, that there are important intellectual forces at work, moving us in the direction which Professor Headley suggests.

The manner in which the paper is organized in four sections is not without problem. The four classes are not mutually exclusive. Some refer to economic phenomena and others to research strategy. Furthermore, as was emphasized in this morning's Presidential address, the source of major social problems may lie more in the interrelationships among several of the topics on Headley's outline than it lies within any one of them. Of course, his discussion indicates that he is well aware of this problem.

I like best that section of the paper dealing with property rights and with institutional economic analysis. It is made very clear to us that such analysis involves more than the prediction of the efficiency consequences of narrowly defined policy alternatives. What is said earlier in the paper leads up to this section. The latter could have been used to organize the entire exposition. In any case, it is very complementary to the discussion of Allan Schmid's paper in a similar session tomorrow.

For the purpose of a more lively discussion, I would like to emphasize, and perhaps overstate a bit, one point made by Headley on the difficulty of evaluating the kinds of benefits and costs under discussion here as the result of the introduction of agricultural technology. As he points out, the social costs of this technology may have been underestimated because our system of evaluation failed to account for certain resource costs. The latter may be represented by environmental pollution, for example, affecting negatively other uses of these environmental resources. But how are these other uses to be evaluated?

Many will argue that agricultural economists

are among the ones who have made considerable progress during the past decade in one of the areas most difficult to treat: the evaluation of outdoor recreational services. Undoubtedly, we have had some successes. But as one who has been a part of the research effort in this area, I must also admit some frustrations. Some of the difficulties which are experienced are analogous to those cited by Headley in his examples of possible pitfalls in evaluating the benefits from agricultural technology. Thus, we must question whether or not in our efforts at economic evaluation of outdoor recreation we derived values which were really the net value attributable to the natural resource component of the utility yielding recreational experience. For many popular types of outdoor recreation, we have experienced in the recent past a tremendous growth in the development of ancillary equipment, the use of which may perhaps be the primary source of utility in the outdoor recreational experience. Certainly the consumer has in this case a wide range of choice in structuring the content of the commodity he is consuming. While we are beginning to work in this area [2], our recreational demand models have generally not allowed for the estimation of this net contribution. The suggestions of Linder [3] to which Headley refers concerning the observed adjustments in intensity with which people use their leisure time may be productive in this respect also.

This is not a matter of small concern. These values are important not only for the purposes of evaluating the use of certain types of agricultural technology but also in support of other programs as well. Almost everyone seems to agree (and the paper under discussion here makes the same implication) that the income elasticities for these kinds of resource services are relatively high. Yet, we have very little empirical evidence to support this contention. We may not even have a model by which we could derive a testable hypothesis about this phenomenon.

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Seminar Session 1.0

AGRICULTURAL PRODUCTIVITY
AND ENVIRONMENTAL QUALITY*Subsession 1.1-Technical and Economic Considerations
in Fertilizer Use*

Chairman: EARL R. SWANSON, University of Illinois

Discussants: James L. Barr and Lawrence Abrams, Washington University, "Some Notes on the Use of Nitrogen Fertilizer and Water Quality"

R. E. Oehlschlaeger, ERS, USDA; D. F. Kraft; and N. K. Whittlesey, all Washington State University, "Fertilizer Technology and Use—Its Relationship to the Environment"

Wesley G. Smith and Victor J. Kilmer, Tennessee Valley Authority, "Technical and Economic Considerations in Fertilizer Use"

*Subsession 1.2-Technical and Economic Considerations
in Pesticide Use*

Chairman: JOHN H. BERRY, ERS, USDA

Discussants: Gerald A. Carlson, North Carolina State University, "Biological Capital Preservation: The Case of Insecticides"

Velmar W. Davis, ERS, USDA, "Pest Management—A Challenge to Economists"

Ronald D. Laceywell, Texas A&M University, "Some Implications of Withdrawing Pesticides from Commercial Agriculture"

*Subsession 1.3-Technical and Economic Considerations
in Animal and Solid Waste Disposal*

Chairman: JOSEPH HAVLICEK, Jr., Purdue University

Discussants: Fred H. Abel, Environmental Protection Agency, "Solid Waste and A Quality Environment"

W. H. M. Morris, Purdue University, "Technical and Economic Considerations in Livestock Waste Management"

Samuel G. Unger and Donald Wissman, Dunlap & Associates, "Economic Implications of Waste Treatment Costs and Control Standards on Agricultural Processors: A Case Study of the Fruit and Vegetable Processing Industry"

Subsession 1.4-Contributed Papers

Chairman: FRED J. PROCHASKA, University of Florida

Papers: Clarence J. Miller, Stanford Research Institute, "Air Pollution and Vegetation Losses in the United States"

George L. Casler, Oregon State University, and James J. Jacobs, Cornell University, "Crucial Knowledge Gaps in the Relationship Between Agricultural Production and Environmental Quality"

James W. Richardson, Oklahoma State University, "Interrelationships of Pesticide Use, Environmental Quality, Costs, and Farm Programs"

Muhammad Ashraf, Harold W. Gaede, Jr., and Robert L. Christensen, University of Massachusetts, "Optimum Dairy Farm Organization in Relation to Water Quality in Massachusetts"

Subsession 1.5-Contributed Papers

Chairman: DALE COLYER, West Virginia University

Papers: L. Thad Horne, NRED, ERS, USDA, and Daniel D. Badger, Oklahoma State University, "Economic and Environmental Impacts of Alternative Insecticide Strategies in Cotton Production, Sunflower River Basin, Mississippi"

Jonq-Ying Lee, University of Florida, "A Simultaneous Equation Model of the Economic-Ecologic System in Citrus Groves"

J. Delphendahl, University of Maine, "The Problem of Resource Use and Quality of the Environment, Some Policy Issues: The Possibility of the Application of Effluent Charge in Maine"

Dilip Pendse and J. B. Wyckoff, Oregon State University, "Measurement of Environmental Goods: A Suggested Approach"

Seminar Session 2.0

COMMUNITY DEVELOPMENT

CHAIRMAN: JOHN O. DUNBAR, Purdue University

Community Development in the 1970's*

R. J. HILDRETH AND W. NEILL SCHALLER

PROFESSIONALS involved in community development work seem to agree on what community development is, although at times we suspect that they have only declared a truce. Even if there is agreement among professionals, a lack of understanding persists between involved professionals and others.

Oddly enough, there is general agreement that the major reason for this confusion is that the goals of community development are abstract and intangible. But progress toward understanding and articulating community development is stymied at that point for two reasons. First, "outsiders" faced with the lack of concrete goals of community development tend to insert what they think are or could be the goals. Second, outsiders who look for quantifiable goals tend to limit their perception of community development goals to those that can be measured.

What is unfortunate about these responses is not the desire to translate community development into specific operational goals, for that must be done. Rather, it is the failure to verify whether those imposed operational goals are the goals of the community. Different outsiders talk about different goals. If there is no effort to prove or disprove the validity of any particular goal, discussions about community development become subtle contests which no one can win.

This goal dilemma should come as no sur-

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R. J. HILDRETH AND W. NEILL SCHALLER are managing director and associate managing director, respectively, of the Farm Foundation, Chicago.

prise. Community development is a normative term. It is not a scientific term nor a theoretical concept. It is not a research problem, but rather a policy objective and a process that people—but not necessarily all people—have labeled "good."

This is not to say that the economist in community development work should ignore values. In fact, this tendency to do so—to leave values to the sociologist—may be a part of the problem. Rather, the economist needs to develop a new sensitivity to values, for they define the changing arena in which he must apply his science.

Clearly, some kind of framework for thinking about community development is essential if a way out of this dilemma is to be found. One possibility is the means-ends framework. It is one that perhaps has been overlooked because it is elementary or lacking in elegance.

The means-ends framework is "old hat" to economists in the policy field. Rainer Schickele, in his textbook on agricultural policy [11], uses it to sort out and evaluate policy alternatives. He treats ends and means as two elements of an action system (Fig. 1). Action systems typically involve a continuum of means and ends. For example, a job is a means to income (end), which serves as a means for buying a car (end), which may be used for recreation (end), and so on.

The system includes two other elements—actors and conditions. The actor may be an individual or some aggregation of individuals from an organization or community to the U. S. Government. The conditions are the "givens" or the setting within which the system operates. The givens include institutions, rules, and customs. They may also be requirements imposed by or on the actor, such as limiting means to those that are politically and economically acceptable.

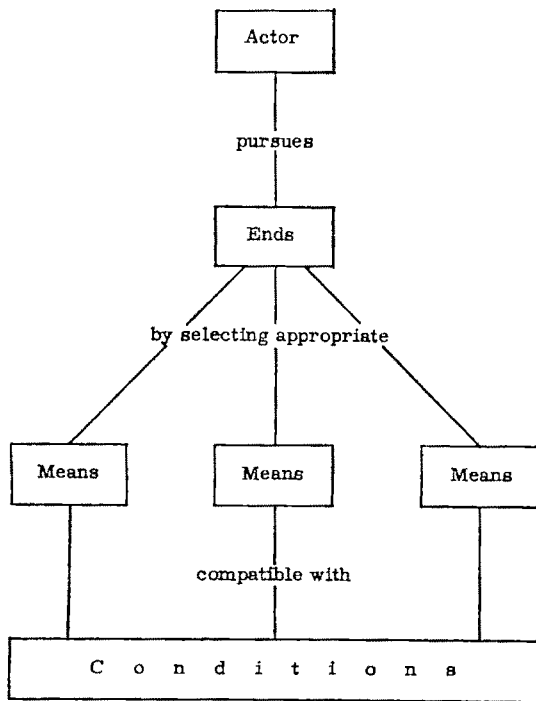


Figure 1. Diagram of an action system.

The Means-Ends Setting for Community Development

Community development can be viewed as an interaction of action systems. The elements interacting in community development include the individual citizen action system, the community action system (which may include a number of systems or organizations), and outside action systems such as federal and state government agencies and private national and state organizations. We take the position that the community action system should be the major focus for community development.

Different actors do not see the conditions, ends, and means in the same light. A sewer system may be a means for an agency that has as its end the improvement of water quality nationally, but for the community it can be a means of a different order for improving citizen well-being. A federal funding program may be one of several alternative means for the community. The local tax structure may be viewed by the citizen as a condition but as a means by the community.

Thus, confusion and sometimes conflict abound. For example, assume the end of improving income in nonmetropolitan areas. Com-

munity development can be a means to that end; but alternative means exist, such as direct transfer payments and programs to promote rural industrialization and migration to jobs. The latter means would involve national or regional programs rather than community-initiated programs. The means may be competitive, supplementary, or complementary. This is the case for a single-action system. It is also the case when different action systems are involved. Here there is a greater chance that the relationships will be competitive because of differences in ends. Thus, community development does not precisely equal rural development, and rural development does not precisely equal national development.

Confusion about these distinctions may help to explain the lack of clear-cut development policies at the federal level. Lynn Daft [3] suggests that we really have no development "policies," only development "programs." Each has its own self-contained target population.

The ideal, of course, is to develop programs which recognize the means-ends interrelationships and to form a coherent policy as viewed by the citizen, the community, the state, and the nation. Although this task may be impossible, the least we can do is to try to understand who the actors are and what effects different programs may have on the achievement of different ends.

Problems of Choosing Community Ends and Means

Because community development is normative, the question of who selects the ends is quite important. According to our set of values, the people in the community should decide. Ends for the community may be set by the larger society, but unless they are accepted by the people in the community, they cannot be attained. This helps to explain why some recent federal programs to help people have had limited success.

A possible community action system of means and ends—partial to be sure—is presented in Figure 2. Improved well-being is assumed to be the highest end (a real community may or may not choose this end). Figure 2 suggests that the well-being of individuals is influenced by many factors. An increase in the consumption of goods and services usually improves well-being. Increases in income and employment provide means for

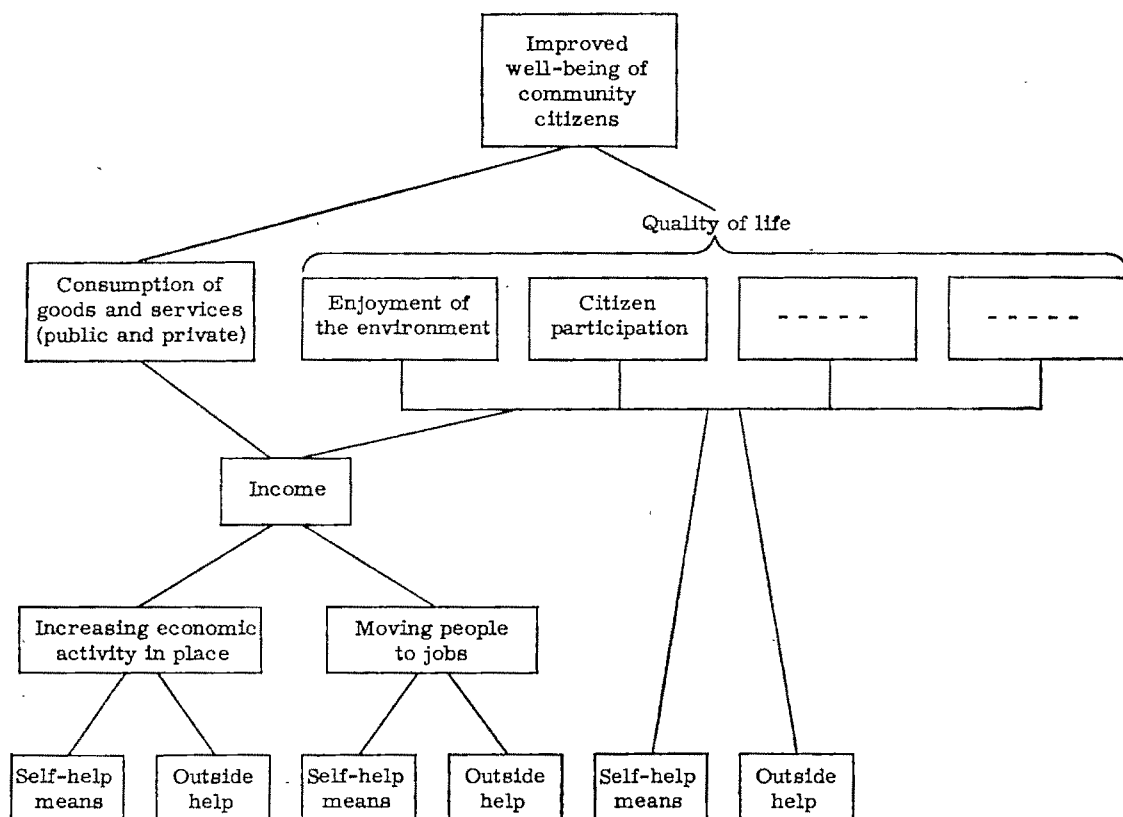


Figure 2. Action system to improve well-being of community citizens

increasing consumption of goods and services. But other factors often put under the heading of quality of life, such as enjoyment of the environment and citizen participation, also improve well-being.

Citizen participation may appear at different levels in the means-ends continuum. It may appear at a lower level as a means for generating action to increase employment and income, which are means for purchasing goods and services, which are means for improving well-being. In other situations, well-being may be directly affected by citizen participation. For example, if the individual or group of individuals feels disenfranchised or discriminated against, participation in the community development process may be an important contribution to their well-being. The continuing concern about "participatory democracy" is evidence that many people consider the process a major end. In contrast, some professionals are inclined to view participation in the process as a lower order means, one that does not fit neatly into a framework like Figure 2.

The process of choosing community ends and means typically involves numerous trade-off problems. To give some order to these problems, it is helpful to distinguish between two general cases. In one case, we view the community as a single actor. In the other, the community is treated as a collection of individuals.

The community as a single actor¹

It is seldom possible for a community to make choices that will improve every component of well-being. Helping the community understand the conflicts between ends can be a major contribution of the professional. Figure 3 illustrates the nature of this problem. For simplification the figure is limited to two likely contributors to well-being: consumption of goods and services and enjoyment of the environment. The figure assumes that a given

¹ We assume the community has methods of reaching agreement. This is a difficult problem for a real community. Economists are not of much help. They usually assume the problem away (as we have) or hold a community utility function exists (which assumes the problem away).

community is now located at point 0. Changes could take place that would move the community from point 0 into quadrant A where it would enjoy an increase in both consumption of goods and services and a better environment. It is perhaps more likely that an increase in one would be accompanied by a decrease in the other, a movement into quadrant B or quadrant D.

These possibilities are more easily recognized by economists if they are shown in terms of hypothetical indifference curves. In Figure 3 the overall well-being of individuals in the community would be the same at all points on the indifference curve I_0 . The well-being of the community would increase when the curve shifts to the right from I_0 to I_1 .

Figure 3 captures only the static side of the choice problem. Time is also an important factor. For example, a community may decide to encourage industrialization, even though that may mean an initial sacrifice in the enjoyment of environment. However, such a choice might mean higher eventual incomes, which would then enable the community to afford better public services.

The community as a collection of individuals

The choice problems facing a community go well beyond those just described. They also include the problems of differential effects of

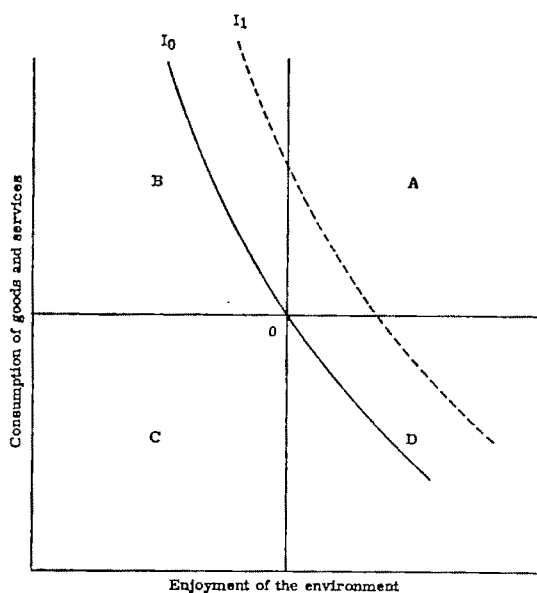


Figure 3

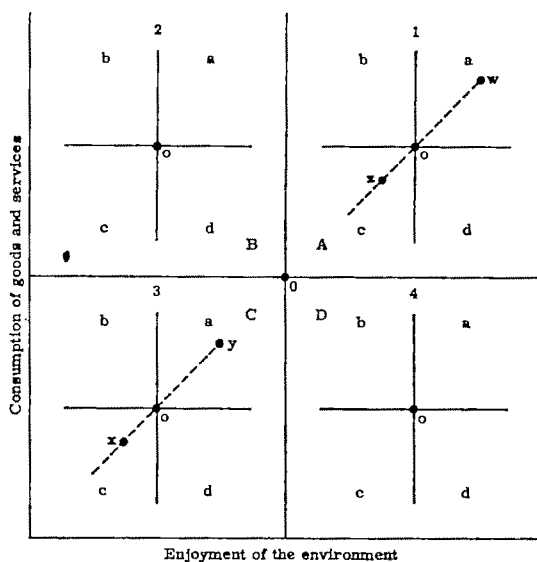


Figure 4

community action on individuals in the community. The relationship between the community and individual citizens can be illustrated in Figure 4.

Suppose that a particular community is now at point 0. This point represents an average of some kind for individuals in the community. Suppose the community consists of four people, numbered 1 through 4 in Figure 4. If increases in well-being mean moving into quadrants A, B, or D, increases in well-being for each individual involve moving into the smaller quadrants a, b, or d. But here we see that there are a great many possible movements of individuals leading to a single change for the community. Movement into quadrant A with one person made better off and no other person made worse off would be recognized by the economist as a Pareto optimum solution. In real life, few such situations are found.

Suppose the community takes an action which moves individual 1 to point w and individual 3 to point x. Or, suppose the community takes an action which moves individual 3 to point y and individual 1 to point z. The net result in both cases would be a movement into quadrant A for the community. The question then arises, are the two actions equally desirable? A person whose value system is oriented toward a more equal distribution of the fruits of development would argue that the second action would be preferred. A person who is not concerned about the distribution of benefits and

costs would give equal weight to either action by the community.

The distribution problem is illustrated by a study of industries located in the Ozark region of eastern Oklahoma since 1960 [17]. The study measured the benefits in the form of payroll and secondary effects as well as costs in terms of additional utilities and school services required for new residents. The results indicated the community could subsidize industry by \$3,800 annually per new job created and just break even. While many people benefited from the new jobs, not all sectors gained. In several instances, the school and municipal government sectors incurred a net loss despite large gains to the private sector because additional taxes did not cover costs of the added services required. Those people who paid higher taxes for added services but did not benefit from the new jobs were made worse off.

Farmers often have questions about development efforts for similar reasons. Many do not see how they would benefit from new jobs although they would pay a large share of the cost of added services through the property tax.

Choosing Among Alternative Means—Two Neglected Issues

Let us single out for further discussion two different issues suggested in Figure 2.

Increasing economic activity in place versus moving people to jobs

Increasing economic activity in a specific location is usually considered a basic step in community development. Moving people to jobs may or may not be competitive with community development. If we are talking about improving educational levels and increasing job skills, it is quite compatible. If we are talking about subsidizing migration away from rural communities, it is not. In the extreme these two approaches—place development and people development, if you will—can represent entirely different means to the well-being of people.

According to Luther Tweeten [17], "Economists, observing that out-migration has reduced per capita income of the sending and receiving areas, have concluded that out-migration best not be encouraged." But he adds that if one is interested in the well-being of rural people, wherever they eventually reside, out-migration has been a resounding success.

Tweeten argues that if the income of people who migrated out of the community is averaged with the income of those who remain, out-migration has indeed raised the income of that group of people. It may have reduced the average income in the receiving area, but it has increased national per capita income.

Bruce MacLaury [6], president of the Federal Reserve Bank of Minneapolis, questions the assumption that people development inevitably means migration to big cities. MacLaury feels that it would be more promising and economical to (1) create jobs in selective growth centers rather than scattering our efforts over the whole countryside; (2) take a more tolerant attitude toward migration from rural areas to identifiable growth centers, and indeed to facilitate such migration in the interest of productive employment; and (3) look toward federal assistance in the areas of education, health, and welfare, not for concentration of such assistance in limited areas, but for helping to provide these benefits to all citizens no matter where they are located.

MacLaury in effect argues for an enlightened combination of people development and place development. Indeed, if one is concerned about the well-being of individuals, the movement of people to jobs is an essential consideration.

This suggests that researchers might make an important contribution by analyzing the proper mix of place and people development consistent with different assumptions about ends. In this regard, employment and income are only a part of the picture. The research would also need to consider the effects of these two means on community services.

Self-help versus outside help

At the bottom of Figure 2 is a set of means which, for lack of better terms, we call "self-help means" and "outside help."

What criteria can be used to determine the appropriateness of these different means? The answer is that it depends on the constraints to attainment of desired ends. This is the case whether we are talking about an individual or a community. The self-help approach would be used when the constraints preventing a higher well-being are believed to be those over which people have considerable control, lack of interest or motivation, for example. In contrast, financial and other outside assistance would be provided to help remove constraints over

which the people have relatively little control, such as lack of jobs, inflation, inadequate resources, and discrimination.

Tweeten [17] argues that self-help efforts have largely failed, citing studies of agricultural development by Back and Hurt and Schultz. He suggests that the per capita income of a community can be extremely low even after that community has achieved the optimum use of its resources. Self-help efforts have brought community improvement but little increase in incomes. Outside technology, expertise, and capital as well as national rural development policy are therefore essential.

The point is that neither the self-help nor the outside help approach alone is likely to improve the well-being of people very much. We should have had enough experience with welfare and development programs at home and abroad to appreciate this point.

Conditions in a Community Action System

The institutional setting is a very important part of conditions, the fourth element in Schickel's action system. The improvement of well-being of people living in a given community depends largely on the performance of existing institutions or the development of new ones. Yet, in our judgment most economists have devoted relatively little attention to them.

Institutions are the rules and mechanisms that give order to the relationships between people. T. W. Schultz [13] defines an institution as a behavioral rule. Institutions include customs, laws, and rights as well as man-made devices like markets to facilitate, guide, and control interactions between people.

Economists differ in the way they regard the role of institutions. Schultz lists three approaches of economists to institutions: (1) omit or impound institutions by abstracting from them (modern economics), (2) treat institutions as subject to change exogenously (institutional economics), and (3) treat institutions as variables that respond to the dynamics of economic growth (Schultz's proposal).²

Charles Schultze [14], talking about the traditional assumption of constant preferences, notes that the economist has little to say about the "... problem of the way in which basic preferences themselves respond to economic development, except to note that 'yes, this does

indeed happen, and the sociologists better get to work.' " The apparent separation of institutional and modern analytical economics may help to explain the current limitations of economics in dealing with relatively new problems such as pollution, changes in the organization and control of agriculture, and, of course, community development. Institutions play a critical role in each of these problem areas. In fact, economic problems often develop either because institutions are changing rapidly or because they are not changing fast enough.

There is a difference between questioning givens, like the institutional structure or values and attitudes, and trying to explain them. Yet, there is evidence that the economist may see both the questioning and explaining as violations of objectivity. The irony is that the economist's pursuit of objectivity may explain much of the criticism that economics lacks relevance.

If the economist does not understand the role of institutions—why they work or do not work—he may fail to diagnose the problem correctly. If he is not aware of the institutional changes taking place, what he takes as given may be outdated. In both instances, research and extension are likely to miss the point that a change in institutions may enhance community development far more than fine-tuning or tinkering with existing institutions.

Many economists are concerned about these problems and are suggesting new ways of thinking about them. Robert Heilbroner [5] offers this thought: "If economics is to become more relevant, economists must direct their energies into areas of the social order that they have heretofore overlooked, particularly areas in which political or sociological elements are intimately intertwined with strictly economic ones... I will only add that 'institutional' economics would seem preeminently qualified to lead the expedition into this dangerous no-man's land." Finally, we are hearing more about a new approach or school called "grants economics," which Martin Pfaff [10] describes as "... concerned with equity and other goals as integral parts of economic inquiry." These and other ideas all seem to suggest that the relevance of economics and the way it is practiced can be improved.

Contribution of Economics—Two Areas

There are many problem areas in which the concepts, logic, and analysis of economics can

² An example of the third approach is contained in Hayami and Ruttan's book explaining agricultural development in a number of institutional settings [4].

illuminate the issues and lead to informed judgment by the community. An examination of two such areas will serve to illustrate the possible contributions of economics.

Development of economic activity in place

Economic logic and analysis could be asked to provide answers to a number of questions about economic activity in a specific location: What causes economic activity in a specific area to increase (growth) or decrease (decline)? What causes the number of types of economic activity in an area to increase (differentiation) or decrease (attenuation)?³ How are the benefits and costs of growth, decline, differentiation, and attenuation distributed to firms, households, and government units? What can an actor—a firm, a household, a government unit, or a community (if agreement can be reached within the community)—do to effect growth or differentiation?

Economic theory has failed to provide operational hypotheses for examining these kinds of questions. Economic theory does much better for the firm or the household. It also does fairly well for national policy questions.

It seems to us that the reason economic logic answers questions better about the firm or the household is that the economist can assume that a single objective function is to be optimized. Although the economist cannot specify all of the aspects of an individual's or a firm's objective function, he can come close enough to reality to predict and explain economic activity. In the case of national affairs again the assumption can be made of a single objective function to be optimized. This assumption is not as close to reality as in the case of a firm or household but often provides a basis for useful analysis of alternatives for policy makers. However, the existence of a single criterion for a specific area which combines firms and households has not been demonstrated.⁴

Economic models have demonstrated their ability to utilize objective functions with mul-

tle goals but only for a firm, household, or "firm-like" organization. Thus, it may be concluded that optimizing models are not always useful for the broader issues dealing with development of economic activity in place.

Another difficulty in dealing with the economics of a specific area is the "openness" of such an economy. One can assume the national economy of the United States to be "closed" because the U. S. economy's reliance on international trade is relatively low. The United States has its own flexible and controllable monetary system which can be used with national fiscal operations to regulate economic activity. Even though the national economy is fairly well closed and is somewhat controllable, changes occur as new markets develop or factors of production move. In this process some specific areas gain and some lose. The general national accounting system reflects only the very gross changes and does not reflect changes in the geographic distribution of economic activity.

There is no lack of attempts to explain the location of economic activity. Numerous economic models and analytical tools are available for such studies.⁵ However, studies reporting the use of various tools show little evidence that these tools help economists predict when or how a specific area's growth path will change. But more importantly, there also seems to be a lack of knowledge regarding the variables or institutions that can be manipulated to effect a desired change.

We wish to suggest two approaches that may be productive. The first would center on the flow of funds or the familiar savings-investment relationship as it exists in a community [1]. A specific area's capacity to import or export net flows of investment capital would seem to be an extremely important determinant of an area's prospects for growth or decline. The savings-investment linkage offers a promising focal point in researching the question of growth and decline as well as differentiation or the lack of it.

On the savings side it would seem important to know the sources of savings, quantities of savings, and the attitudes of savers toward the various institutions that vie for the opportunity to invest. On the investment side, knowledge regarding sources of investment funds, particularly whether these funds originate internally or externally, efficiency of investments, impediments to desired investment patterns in

³ A matrix of growth and decline, differentiation and attenuation was suggested by Paul Barkley [1].

⁴ We are indebted to Keith Bryant for the following thought: "It is curious that a discipline with its feelings well sunk in the bed rock of individualistic philosophy has developed models and decision-making tools so useful to the dictator, be he a firm manager, a family head, a bureaucratic manager, or a dictator of a nation-state. Distribution issues *within* the firm, the family and the nation do not appear to be the economist's 'cup of tea.'"

⁵ An excellent review of various approaches is contained in an unpublished working paper by Ndosi and Herder [8].

either the public or private sector, and the attitudes of potential investors regarding various options open to them are quite important.

Other avenues of approach could be tied to an understanding of the savings-investment linkage for specific areas. The external costs imposed upon the firm by geographic isolation has limited growth in many small communities. It would be quite useful to know the sources of the external influences, the ways in which these influences might affect an area, and the magnitude of the resulting effect. It may be that a comprehensive and intricate study of the savings-investment relationship would reveal previously unrecognized external influences. On the other side of the coin, studies of external costs and benefits may yield clues to understanding the working of the savings-investment relationship.

A second suggested attack is the application of economic thought surrounding market and bargaining relationships to an understanding of the economic activity of a specific area. In 1951 T. W. Schultz in a very provocative article [12] discussed the relationship of land as a productive resource to other inputs and to outputs, especially the value of the human agent in farming. He developed three propositions for explaining why major parts of agriculture fall behind in the process of economic progress. The first proposition was that economic development occurs in a specific set of economic relationships and does not necessarily occur in the same way at the same time, or at the same rate in different locations. The second proposition was that increases in economic activity are more potent at industrial-urban locations. The third and most crucial proposition is that the existing economic organization works best at or near industrial-urban locations.

Schultz may well have anticipated much of the more recent developments in regional economic thought. Much of the interregional competition, interregional trade theory relates to the first proposition. Clearly, the second proposition relates to the growth pole and agglomeration concepts. However, the functioning of economic organizations has not been particularly investigated as a cause of differential rates of growth and development within given areas (the third proposition). Schultz's article generated much research in the field of agricultural economics to test his proposition about agriculture. It seemed to us that it might be a useful research investigation to determine

if the functioning of economic organizations is related to regional development.

Defenders of the *laissez-faire* approach suggest that markets can solve disequilibrium problems if left alone. Critics of markets argue for intervention on the part of the government in terms of investment in infrastructure, government investment, differential tax rates, credit policies, etc. A knowledge of how economic organizations work might provide background for intervention by the public in setting the rules of the game to make markets work better. McKean [7], following Arrow, has suggested that market failure in our society really means lack of markets. If evidence were obtained for the hypothesis that the operation of economic organizations is important (we include a market as an economic organization), then we could have some idea of how to change the rules that create and surround markets to make the markets work more effectively. Such a policy prescription would seem to deal with the problems of externalities because externalities exist when there is no market to deal adequately with the costs or benefits generated. Along with the study of markets it would be desirable to have measurement of what are now external costs and benefits.⁶

Delivery of services

A recent report prepared by the Economic Research Service [18] concludes that "among the deficits in social overhead in nonmetropolitan areas is the quality of both medical care and education." The report also states that nonmetropolitan areas with approximately 30 percent of the population have about 60 percent of the substandard housing units. The cost of purchasing the same goods is usually higher in rural areas than in metro areas. Transportation problems abound in rural areas.

The issue is not simply that public services are inadequate in nonmetro areas. Both public and private services are often not as available and of lower quality in rural areas than in metro areas.

The decisions necessary to improve the delivery of public services are often quite complicated and involve understanding of subtle relationships. Especially troublesome are prob-

⁶ George Tolley [16] has presented an interesting analysis of some of the common environmental problems and opportunities.

lems of measuring the quality of services and the definition of the product. Consider, for example, the difficulty of thinking about health care. The health of the people in a community may not be vastly improved by the effective treatment of illness. Even with an "adequate" number of physicians and hospital facilities the number of people utilizing them is relatively small. The health of individuals is never directly related to the number of physicians or facilities. Most of the decline in disease incidence and mortality rates and most of the increase in average life expectancy has resulted from influences other than efforts at controlling specific diseases. Thus, improvements in the delivery of health care services in rural areas are important but probably will not improve proportionally the health of individuals in a community [15].

Leaving aside problems of quality, there are subtleties in cost relationships. The unit providing a service is often faced with a falling average cost curve. Thus, in any specific area with a declining population, a usual answer to increasing costs is to increase the size of the area served in order to take advantage of economies of scale. However, in such a situation, as the size of the geographic area served is increased, average transport costs for the users of the service will increase. The average total cost to the user and provider thus would be a U-shaped curve with a minimum cost point at a somewhat lower volume than if only provider costs are considered.

There appears to be ferment in the field of public administration which is closely related to the delivery of public services. Vincent and Elinor Ostrom [9] contend that many of the bad features of traditional public administration, such as overlapping jurisdictions instead of a single integrated hierarchy of authority coordinating all public services, can really be good. They suggest treating police services, educational services, water services, and other public services as industries. Market-like mechanisms for these industries could be developed through a combination of user taxes, service charges, and intergovernmental transfers of funds and voucher systems. The Ostroms conclude, "Perhaps a system of public administration, composed of a variety of multi-organizational arrangements and highly dependent upon mobilizing clientele support will come reasonably close to sustaining a high level

of performance in advancing the public welfare."⁷

Central to these kinds of ideas is the aim of devising a system for delivering public services that will increase the individual citizen's range of choice and access. The public administrator should serve users or consumers of public goods and services and not political masters. Where the service to the individual is not sufficient in presently organized government agencies, the problem is with the organization and the concepts leading to the organization. As McKean [7] points out, a government official can "appropriate" certain of the benefits from his decisions but not all of the benefits and costs. He thus is guided by what he can appropriate. If the government official is rational and follows his own self-interest, his decisions will likely lead to a service to the organization rather than the individual. In such cases the rules may need to be changed. The theory of externalities, common properties, and public goods, the logic of collective action and public enterprise, and the concepts of public service industries will be very useful in suggesting changes in the bureaucracy. In the area of public administration we need to find ways of helping communities to fashion organizational arrangements which will put individual self-interest to proper use in advancing human welfare.

Keith Bryant [2] has made an analysis of the market for food stamps. He postulates two models of the Food and Nutrition Service and tests them against available data. The analysis takes the ideas of revenue and cost and applies them in innovative ways to understanding the behavior of a government agency. Will the results of this and similar analyses enable us to make the kind of organizational and institutional arrangements necessary to improve the delivery of public services for a specific community?

Concluding Remarks

Ten years from now there may well be a paper at this meeting titled "Community Development in the 1980's." This is because community development is not a problem to be solved once and for all. It is more nearly a

⁷ Also see the works of Buchanan and others at the Center for Study of Public Choice, Virginia Polytechnic Institute and State University, and publications of the Public Choice Society.

process that is never completed. Professional dialogue about community development has the same characteristic. Like community development, our paper will be useful only if it contributes to the never-ending process of

improving the well-being of people. It will do that only if it causes you to think about community development in better ways than we have.

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Discussion: JOHN S. BOTTUM, USDA

I have enjoyed the assignment to react to this paper because it is a good paper—perhaps not supremely outstanding, but a good paper right out of the Heartland of America; not extreme, not daring, but middle of the road and solid. Its authors are two scholars who have observed hundreds and probably thousands of us who have been working in community development in recent years. I think the paper reflects their observations.

In addition, it reflects the comments of the

12 noted in the first footnote—a formidable group.

As I said, it is a good paper and I am not going to argue too much with what is in it; however, I am disappointed by some omissions if we are really talking about community development in the 1970's.

First of all, I wish the paper had more of a sense of urgency to it. For community development, the time is now. This nation is starving for the fruits of this effort. Some in high places

say, "The people are fed up with government, and they have a right to be." We are rich in "production" but poor in "well-being," which the authors view as one of the major ends. I am afraid we have been optimizing the wrong ends in many of our sophisticated models.

The need for community development work was never greater. Lack of job opportunities and inadequate community services and facilities continue to contribute to out-migration from far more than half of the counties in rural America. The population drain in rural areas and the amassing of millions more in a few huge metropolitan areas have created tremendous problems for both rural and urban America—poverty, crime, congestion, pollution, and exorbitant social costs in the cities; and inadequate health, education, and manpower services, insufficient job opportunities, low quality housing, and forced migration of young people from the rural areas.

Also, the opportunity for citizens to participate and have a voice in their community is urgent, and I was pleased to see the authors emphasize this. These are the kinds of things that community development is all about. It is the people of the community getting together and deciding what is the next problem that they are going to tackle and what can they do about it, and what is possible and what are all of the ramifications. Then it is choosing and doing it. It is deciding what will be the next unit of investment in the community which will achieve their goals and improve their well-being and then making that investment.

The paper uses the term "confusion" on several occasions. I think confusion surrounding the term "community development" was a hang-up for the 1950's and 1960's but not for the 1970's, except as some use it as a diversion and stalling tactic—this holds for university administrations as well as the faculty.

But I really think the administrations and the Land-Grant Association gave you, as faculty working in community development, a tremendous vote of confidence when they pushed hard for new legislation to support an expanded effort in community development research, extension, and training. They have been instrumental in getting that legislation through as part of the Rural Development Act of 1972. The Act authorizes appropriations of up to \$10 million the first year, \$15 million the second, and \$20 million the third for extension and research relating to rural development and

small farms. I think Land-Grant's initiative relative to this legislation is a very significant "vote of confidence" in its community development faculty and the fact that the time for community development is now. I really think that the 1970's is the time for extension, research, and teaching to deliver or to give their role in community development to someone else.

I would have liked the paper to convey this tone and sense of urgency. But in spite of the omission, a careful study of the paper can help us deliver in the 1970's.

The authors give us a framework for our thinking about community development. I think their "means-ends" framework is useful, especially as you tie the policy alternative-and-consequences notion to it. The framework can help us put the numerous pieces relating to community development together.

Then when you add the various roles of the actors (agencies, groups, citizens), you have quite a good picture of the community development process. One role of the professional working in community development was footnoted. But I wish they had listed and discussed other roles since their paper conveys a concern about the role of "outsiders" working in community development. Austin Bennett [1] has listed five possible roles for the professional working in community development. Bennett's categories are: Process Consultant, Technical Consultant, Organizational Leadership, Program Advocate, and Resource Provider. Of this list, the economist, as an economist, is most likely to play the Technical Consultant role.

Another discussion that would help round out the means-ends framework and the paper relates to the section on "Choosing Community Ends and Means." I do not believe the section ever really gets down to how communities choose.

Figure 4 implies that if one person is made a little worse off and another a lot better off, the community is better off. This is true, but it does not recognize the difficulty in translating this into a community decision. For example, any gain whatsoever for an individual would likely produce a "yes" vote, and any loss whatsoever would produce a "no" vote. Hence, in the case of the Ozark region study, the large gains of the few who would get new jobs and of the businesses that would serve them could easily be offset by the small losses that the masses would have through higher taxes. Or,

the few votes of the influentials could offset the many votes of all the rest.

The point is that community decision making is complex, and a discussion that goes well beyond the traditional "social action process" needs to accompany the means-ends framework. I see it as a priority area for research.

Communities certainly need and want information relating to place vs. people development or the idea of moving jobs to the people vs. moving people to the jobs. This is another prime area for research and extension efforts. The discussion on this is excellent.

In the discussion of self-help vs. outside help, I felt that the self-help concept was sold short. We have grown to believe that development is a federal program. This simply is not so. The \$35 to \$40 billion of federal dollars plus a few State dollars do not go that far in a year. The vast majority of development occurs and likely will continue to occur with local initiative, local leadership, and local resources.

The authors point out that the self-help approach assumes there are constraints preventing a higher well-being and that the local people have considerable control over these constraints. In many, many cases they certainly do have control over the constraints. Much can be done in nearly every community to improve well-being by reallocating resources within the public sector (more libraries vs. fewer roads), or between the public and private sector (higher taxes vs. fewer public services), or by improved opportunities for citizens to participate and have a voice in the decisions of the community.

Even the changing of institutions can sometimes occur through the self-help approach.

Regarding institutions, the authors point out that the improvement of well-being depends largely on the performance of existing institutions or the development of new ones; and "that a change in institutions may enhance Community Development far more than fine-tuning or tinkering with existing institutions"; and "that in the area of public administration we need to find ways of helping communities to fashion organizational arrangements which will put individual self-interest to proper use in advancing human welfare."

These are excellent points as they relate to communities, and they are excellent points as they relate to universities.

The authors seem to imply that the university's contribution to community development

will be through the existing departments. They argue, however, that the economists ought to be more relevant and have more political and sociological elements and institutional economics, but basically they are economists. I agree there is a very important role for specialists in existing departments. In fact, nearly every department on campus should be applying some of its expertise to community development. But I do not believe any of these departments can be the core group that will move community development. I see a new field of knowledge emerging—not a discipline but a field of knowledge. As agricultural economics and agronomy are fields of knowledge, so is community development. My concern is that agricultural economics departments will not provide students the opportunity to gain the concepts they will need as professionals in community development or that departments will not hire the graduates who have acquired the necessary training to do community development work. Self-interest simply locks the faculty into being economists, not professional community developers.

The community development professional requires competencies that go beyond the single departments of rural sociology, political science, agricultural economics, planning, etc. Hence, I am arguing there is a field of knowledge, there are professional community development people; and we need separate curriculums and separate criteria for hiring and promoting if we are to put individual self-interest to proper use in advancing human welfare as the authors suggest the communities should do. Ideally this would require a new department or school. However, there are other and perhaps more feasible alternatives. One is a joint department the same as we have with agricultural economics and rural sociology in several universities. We could add community development to this and have a Department of Applied Social Sciences or a Department of Agricultural Economics, Rural Sociology, and Community Development. If that title is too long, we could come up with acronyms like: AECDRS, C-DAERS, R-SAECD.

Another possibility would be to have, as does Purdue University, a community development faculty in the same sense as you have a graduate school faculty.

The main point is that you provide a home for the core group of professionals in community development. Many others, such as

agricultural economists, would remain in their departments working on the very important aspects of community problems relating to their fields of knowledge. I see this as a real need in the 1970's and would like to have seen some reference in the paper to the fact that

there are full-time community development professionals.

In summary, it is a good paper and warrants careful study by all faculty interested in community development.

Reference

- [1] BENNETT, AUSTIN, "The Professional Staff Member's Contribution to Community Change," presented at the National Community Resource Development Work-

shop, Salt Fork State Lodge, Cambridge, Ohio, July 26-28, 1972.

Discussion: GENE McMURTRY, Virginia Polytechnic Institute and State University

The paper by Hildreth and Schaller has many good ideas and generally I agreed with most of it. Perhaps it is because I find myself agreeing with much of the paper that I am somewhat disappointed in the final outcome. To a large degree it revolves around my very high expectations of Jim and Neill.

I guess I am upset because there was nothing in the paper that upset me. Perhaps I was looking for those "crazy" ideas that would allow each of us to be stimulated, to be angry, and even to remember our AAEEA session. Though the title seemed to indicate a projection of community development into the 1970's, the paper did not provide insight into the priorities for community development.

Our ability to communicate with each other is the first prerequisite for sound and imaginative programs. Community development has been used to motivate citizens through the social action process to improve and strengthen community decision making. This means working on problems requiring group decisions. It also means an understanding of who has access to the use of resources is not in itself sufficient. We must also consider the standard and quality of the resource. While all children may be able to climb on a school bus, the quality of education provided at different schools may be substantially different. What is needed is not a discussion of Pareto optimality but an understanding of how development occurs and the impact of income distribution policies upon communities.

In the communities where I have worked there is rarely any early support for a goals discussion until the group has matured by working together on a number of specific problems. Trust is nur-

tured and developed as a community group works on joint projects. Often the "goal dilemma" is of much greater concern to the outside agency person than to community leaders. Meaningful discussion of goals must be timed to group needs and not professional staff needs.

The means-ends framework has meaning in community development work. The problem is with professionals working in community development and their use of the means-ends framework. Hildreth and Schaller are no exception because in one part of the paper community development is discussed as an end and later it is discussed as a means. It appears to me that most practitioners would indicate that community development reflects the broader aspect and is an end rather than a means to an end. It is partly a confusion of the words that makes it so difficult for community groups to grasp what professional economists are really talking about. The section of the paper on how community ends are chosen is useful, but what is really needed are strategies for choosing community ends in the midst of real or perceived crises.

All of us prefer to see things from our vantage point. This would include the way we look at community development. The debate and discussion concerning the definitions and methodologies provide a type of boundary maintenance around "our" part of community development.

One way of responding has been "have process; will tackle community concerns." In a real sense this approach has been successful. However, as agricultural economists tackle problems outside our background and training, there builds up a sincere feeling of hesitancy and uncertainty. While we can discuss the roles of different actors, what we really need is knowledge

of how to develop meaningful relationships with new clients and even new allies.

Policies are made within the system of power clusters. In a community this will include political parties, groups, organizations, and agencies. These clusters include a network of ties built up over time among its members. Key individuals are often on a first-name basis, communicate frequently, and check signals before reaching major decisions. Most understand the relative power of each of the components and the principal actors within their cluster. This includes the leaders of state and local government, agencies, committees, groups, and even university professors who do extension or research in the particular field. There are compromises between the power clusters as well as within them. Policy makers (politicians) expect the intra-cluster compromises to be hammered out before policy proposal is laid before them. What should be the role of community developers and economists in achieving viable compromises for effective plans for action?

The introduction of effective leadership can modify existing community power clusters. I sincerely believe that a part of our job is to provide an opportunity for community leaders to grow and develop. We need to seek and rediscover local initiative. In the work that I have done in many communities I have seen individuals with motivation create a kind of spontaneous action because they have been willing to work for the good of the community. This is the basic concept involved in a "sense of community."

While citizens within most communities have a strong feeling for democracy, they are frustrated because they cannot perceive how they can influence the policies which have meaning in their lives. Today's world with its complex interrelationships produces an environment which may not bring out the individual's worth. Many have observed this citizen dissatisfaction and wonder why people are reluctant to take charge of their own destiny. There obviously is no simple answer to this complex problem. Yet there is the "expert syndrome" often expressed as, "we can't afford to let the citizens decide on such important issues." It may well be that community decisions are too important and serious to be left to the *experts*.

Into this situation arrives the economist or community developer who finds that the planner has been there before him (although this planner may be new to this particular geographic area). Comprehensive planning is an approach through which to modify alternatives and thus control

consequences of community action. The practice of talking to people other than highly trained professionals is often lacking. Thus those who are schooled and skilled in elaborate techniques are the ones to act since they feel that they know what is best for the community.

While the role of the economist may be considered important from out vantage point, it is not considered critical by most regional planners. A network of community development partnerships can be forged where the agricultural economist would have the ability to provide inputs into the community decision-making arena. Our real opportunity is providing an environment where communication can take place.

Good communication and citizen participation are tools for reducing conflict and for providing cooperation on common projects. Distrust often develops through events where community selfishness erupts into conflict. People and communities do not quickly forget past events and it often takes years to erase the distrust developed over a specific situation. The challenge is to reach leaders who can rise above the problem of community distrust and not let it be a stumbling block to cooperation and progress.

One of the things that always haunts me is the way we help communities. It is intriguing to reflect on the plight of many rural citizens as a result of our price support policies. What will be the plight of the rural or urban citizens as a result of community development policies? Economics quite successfully provides a framework regarding choices. The market is one way of making choices, but only one. Nonmarket choices are of increasing importance, but too often only limited attention has been devoted to them. To me the nonmarket choices revolve around real or perceived alternatives and their consequences. It is possible to use the means-ends framework for guidance in this area. An understanding of the choices within the intra-power clusters would be of significant help to workers in community development.

The mosaic of our communities contains many problems that must be faced by the citizens in each of our states. The dynamics of mobility and migration of population to urban areas have brought forth a need to understand the problems and adjustments of individuals and communities. Programs in community and area development have demonstrated their effectiveness as a part of the overall educational effort. The land grant university continues to make an impact on the

lives of citizens and our changing environment. Our profession can also make a major impact on communities, but real dedication and full support are needed. The challenge is for each of us to understand the strategies that work in a community rather than to worry over who gets the credit. The paper by Hildreth and Schaller brings to our attention the necessity for our commitment to community development in this decade.

Seminar Session 2.0 COMMUNITY DEVELOPMENT

Subsession 2.1-Realistic Policies for Creating Jobs and Income in Rural America

Chairman: STEVEN J. BRANNEN, University of Georgia
Discussants: Robert W. Rudd, University of Kentucky, "Realistic Policies for Creating Jobs and Income in Rural America"

William J. Lanham, Clemson University, "Realistic Policies for Creating Jobs and Income in Rural America"

Subsession 2.2-Providing Facilities and Services Needed for Rural Communities

Chairman: GEORGE S. ABSHIER, Oklahoma State University
Discussants: Wilbur R. Maki, University of Minnesota, "Providing Facilities and Services Needed for Rural Communities: Financing"

John M. Huie, Purdue University, "Effecting Change in the Structure of Local Government"

Subsession 2.3-Policies and Programs for Developing Human Potential

Chairman: GLEN C. PULVER, University of Wisconsin
Discussants: Richard Robbins, North Carolina A&T, "The Role of Cooperative Education in Developing Human Potential"

Glenn L. Nelson, OEO, HEW, "Developing and Realizing the Human Potential for Nonmetropolitan Residents"

Subsession 2.4-Contributed Papers

Chairman: A. RAYMOND CAVENDER, Auburn University
Papers: Donald Lybecker, Southern Illinois University, "Alternatives for Rural Towns in the 1970's"

James I. Mallett, Texas A&M University, "Spatial Equilibrium and Regional Development"

Gary N. Bovard and Leroy J. Hushak, Ohio State

University, "Determinants of Land Values at the Urban Rural Fringe"

John T. Scott, Jr. and Gerald Karr, University of Illinois, "Effects of Agricultural Research on Rural Community Organization and Development"

Subsession 2.5-Contributed Papers

Chairman: JEAN B. WYCKOFF, Oregon State University
Papers: James C. Barron and Ken D. Duft, Washington State University, "A Matrix Organization for Extension Community Resource Development Program Planning"

Michael H. Cosgrove, Oklahoma City Municipal Government, "The Value of Information Systems"

Michael H. Cosgrove, Oklahoma City Municipal Government, "The Role of Water Service in Regional Development: An Ohio Study"

Ron E. Shaffer, University of Wisconsin, "Net Income and Employment Effects of New Industry on Rural Counties and Communities in East Oklahoma"

Subsession 2.6-Contributed Papers

Chairman: PAUL STONE, North Carolina State University

Papers: Richard F. Bieker, University of Delaware, "The Effects of Employability and Employment Opportunities in Determining the Work Force Status of Local Hired Farm Workers: An Application of Discriminant Analysis"

T. F. Glover, Ohio State University, "Consolidation and the Supply of Community Services"

Leroy J. Hushak, Ohio State University, "Factors Affecting Public School Expenditures"

David Holland, University of Kentucky, "Impact of Migration on Efficiency of School Funding"

Subsession 2.7-Contributed Papers

Chairman: C. C. MOXLEY, University of Florida

Papers: Robert D. Stevens, Michigan State University, "Three Rural Development Models for Small Farm Agricultural Areas in Low Income Nations—Some Results from Comilla, Bangladesh"

Ivan W. Schmedemann, A. B. Wooten, and William W. Saitta, Texas A&M University, "The Real Property Tax and Its Role as a Land-Use Control for Community Development"

Dean Schreiner, George Muncrief, and Bob Davis, Oklahoma State University, "Solid Waste Management for Rural Areas: Analysis of Costs and Service Requirements in a Planning Framework"

Gail E. Updegraff and Werner Kiene, Michigan State University, "Rural Health Services Planning and Evaluation"

Sectional Meeting A

AGRIBUSINESS RESEARCH

CHAIRMAN: WILLIAM A. CROMARTY, Connell Rice & Sugar Company, Inc.

Statistical Vs. Judgment and Audience Considerations in the Formulation and Use of Econometric Models

RICHARD T. CROWDER

PRIMARILY because of its usefulness in analyzing economic relationships, econometrics has found great favor throughout our profession. However, within the profession there are basically two groups of econometric model builders. One is the theoretical group. The other is the user group. Both are important. However, there are fundamental differences that result in different approaches in the formulation and use of econometric models. The two most basic differences are the audience and objectives.

To the theoretical group, the audience is composed primarily of professional economists, econometricians, and statisticians. This is an audience that, in general, will demand and reward rigor and complexity in the solving of a theoretical problem more than it will simplicity and judgment in the solution of a practical problem. It is an audience that understands and appreciates such things as the differences between short- and long-term elasticities and the meaning of differences in standard errors of beta coefficients obtained with different estimating techniques.

It is not surprising, therefore, that the major emphasis of many econometric studies is a comparison of such things as the standard error under alternative estimating procedures or the coefficients under two-stage versus three-stage least squares. The primary considerations used by the audience in evaluating the model are economic and statistical in a technical sense. What is the R^2 ? Is there autocorrelation in the residuals? Are the signs of the coefficients consistent with expectations? Are the coefficients of the variables significant?

The audience of the user group is different. It does not understand the technical points of statistical and economic relationships. It is an

audience that appreciates econometric models only to the extent that they are useful in decision making. The primary consideration in evaluating the model is "did it help make a better decision." Therefore, the user group has to formulate models whose results can be interpreted and explained in a manner consistent with the decision-making process of its audience. This nature of the user group audiences and problems requires going beyond normal statistical considerations in the formulation and use of econometric models.

The objectives of this paper are (1) to point out that there are gaps between the rigor of textbook econometrics and its use in solving day-to-day management problems; (2) to cite some problems where these gaps have to be spanned; and (3) to spell out and evaluate some approaches we have used in trying to span these gaps.

Decision Making and Practical Problems

The key element in many operating decisions is price. In most cases, the relevant price is a future price—one that is not known with certainty. Consider the problem of inventory accumulation. Any meat packer, for example, can sell his output of pork trimmings in the current cash market or store the trimmings and sell them at some future time. There is no futures market for pork trimmings. So, if the product goes into the freezer, it goes in on the basis of expected prices.

Another problem is forward selling. When forward sales are made, you commit yourself to a price level that may differ significantly from the market price at the time the product is delivered.

Finally, consider the problem of production scheduling. In an integrated broiler operation, for example, pullet chick placements must be based on production schedules up to 18 months into the future. Eggs for broilers are set three

months prior to slaughter. Because of the low margins, fixed costs, and wide seasonal swings in prices in this industry, future prices are critical to production scheduling. In our operation, we evaluate the relationship between fixed and variable costs at different levels of operation. Then, based upon these costs and our price forecasts, we schedule the number of hours to operate our plants. These hours are then fed into a simulation model in which breeder placements, egg settings, and chick placement schedules are generated.

Where such uncertainty exists, decision rules must relate to the probabilities of a given price level. The probabilities may be subjective or objective. In our company where decisions require an input of future prices we make an explicit price forecast. In addition, we give probabilities of the price falling within given ranges. Decisions are then based on the forecasted price and the probability limits around this price. The decision rule is

$$D(X_i)/(q(P > P_0)) > q_j$$

where

$D(X_i)$ = decision to take action X with intensity i

$q(P)$ = probability of price P

P_0 = specified price

q_j = probability level j .

The decision rule says that decision X is taken with intensity i if the probability that the price will be greater than or equal to P_0 is greater than q_j . For example, 50 percent of broiler production might be hedged if, based upon our price forecast, the probability is 80 that the cash price in the delivery month will be below the current futures price for that month. However, only 20 percent might be hedged if this probability is only 60 percent.

It is to be noted that under such a decision rule the reliability of the probability limits is equal in importance to the reliability of the forecasted price. The greater the accuracy in both the level of the price and the probability intervals around that price the better the decision can be.

Theoretical and Practical Gaps

It is in the projection of future price levels and particularly in the error distribution around these levels that we find the greatest gaps between theoretical and practical applications of econometrics. These gaps stem from (1) the assumption that the independent variables are

known and measured without error and (2) the assumption that relationships outside the period of estimation will be the same as those during the time the model was estimated.

In the textbook case, price models are estimated using historical data which are assumed to be known and measured without error. The researcher estimates a number of equations. From these he selects the one with the highest R^2 , the lowest standard error, and the one with an acceptable Durbin-Watson statistic. He checks to see that all signs are consistent with expectations and that all coefficients are significant. From this he concludes what the price flexibilities or elasticities are and a chart is drawn showing the fit of the estimated and actual values. This is as far as it is necessary for him to go.

One can live with the above procedure in the analysis of historical data. However, when the forecast of a price or quantity in a future period requires forecasting some of the independent variables, it can no longer be assumed that the independent variables are known and measured without error. A consequence of this is that the standard error of estimate or forecast obtained during the period of estimation is normally not reliable for decision making. Errors in the independent variables will, except to the extent compensating errors are made, tend to increase the error in the actual forecast compared with the standard error of the model.

Some analysts have attempted to overcome the problem of having to forecast independent variables by finding a series of lagged variables that are highly correlated with the independent variable in time t . For example, if one wanted to develop a model to forecast prices six months into the future, only independent variables with at least a six-month lag would be used in estimating the equation. The objective of the procedure is desirable. However, our experience has been that too many times the analyst ends up with an equation reflecting high correlation and not cause-effect relationships. Consequently, when forecasts are made outside the period of estimation large forecast errors frequently occur.

The second problem is that of differences in relationships between the dependent and independent variables outside the period of estimation compared with the estimation period. In publications, results that were obtained during the period of estimation are generally reported. The inference to be drawn is that we

can expect these relationships to hold into the future. Such is frequently not the case. That combination of conditions which existed during the base period may not exist in the future. One is most likely to find post-estimation relationships more comparable to those estimated in cases involving physical relationships than in those involving market conditions. Physical relationships do not change as rapidly as do market relationships. The point is that even if all values of the independent variables were known and measured without error, the errors in forecasts could be greater than those suggested from statistics of the model.

Estimation and Use of Models

Our approach to the problem of using the model outside the period of estimation is to test the model outside this period prior to use. If we are estimating an equation for predicting monthly prices, we do not use the most recent historical data. Instead we estimate the model using data for all but, say, the latest three months. Once the equation is estimated we feed in the known values for these last three months and test the accuracy and sensitivity of the model in forecasting outside the period of estimation. In this procedure we will estimate a number of equations and test each. For example, we will drop variables whose coefficients are not significant and compare results with these variables in and out of the equation. Occasionally, we end up with variables in the equation whose coefficients are not significant in a statistical sense. Once we have tested the model outside the period of estimation we will then incorporate the unused data into the model.

We do not follow a policy of reading our price forecasts right from the model. This may not be technically correct, and it is possible to argue that if you had the "right" model you should read directly from it. For prices of most commodities we have not been able to develop such a model. In our rather extensive use of outside consultants we have found many who do not have the "right" model. In fact, based upon past experience, we are very reluctant to use forecasts in which the forecaster says, "all forecasts were taken directly from the model." If the model provides the forecaster with the only knowledge he has of the market, then he has too little knowledge of the market to be a good forecaster. It is impossible to incorporate all market forces into a useful

model. Thus, our forecasts are the product of a model and judgment.

Our judgment is based upon a series of factors which are used in addition to a model in forecasting. These factors include: (1) The recent performance of the model. Has it been consistently high or low? (2) Historical price levels in a given time. Is the model giving a price that is outside the historical range for the comparable period? (3) Are there extreme values in the independent variables? Is there a value in the independent variables that is outside the range for that variable during the base period? (4) Is the relationship of the price to prices for surrounding time periods consistent with history? (5) Given the supply estimate for the time period, what does the price imply with respect to retail or wholesale expenditures in the time period compared with historical and surrounding time periods? (6) Finally, all of the above are summed up with "feel" and a forecast is made. The forecast may or may not agree with the price given by the model.

We try to keep our models simple. This is true for several reasons. First, more complex models such as simultaneous equations tend to break down quicker and become obsolete. Simple models, on the other hand, are more stable but may require more judgment. Second and more important, the simpler the model the easier it is to explain the results to a lay audience. If forecasts are to be useful for decision-making purposes, decision makers must understand and have confidence in them.

Probability intervals around our forecasts are not based upon statistics obtained from estimating the model. Instead, we keep a record of our forecasts and compute a standard error of forecast based upon actual prices and prices we actually forecasted. Our standard error of forecast is defined as follows:

$$E = \sqrt{\frac{\sum (P_a - P_f)^2}{N - 1}}$$

where

E = standard error of forecast

P_a = actual price

P_f = price forecasted

N = number of forecasts.

This procedure allows for errors in the variables, the judgment we use in our forecasts, and the fact that we use the model beyond the period of estimation. A key advantage of this

Table 1. Comparison of selected forecast evaluation statistics for forecasts as actually made versus forecasts taken literally from model^a

	Number of Quarters Forecast in Advance					
	I		II		III	
	Model ^b	Used ^c	Model ^b	Used ^c	Model ^b	Used ^c
Sum of Errors	10.35	.45	15.45	8.45	13.35	8.50
Average Error	0.52	.02	.81	.44	.89	.57
Absolute Sum	14.25	6.15	16.95	12.35	17.25	12.90
Average Absolute Error	0.71	.31	.89	.65	1.15	.86
E^2	.69	.15	1.69	.76	2.33	1.12
E	.83	.39	1.30	.87	1.53	1.06
Mean Price	26.74		27.10		27.19	
EV^d	3.1	1.5	4.8	3.2	5.6	3.9
Number of Forecasts	20		19		15	

^a Forecasts were for U. S. Grade A broiler prices, Chicago.

^b Statistics based upon what forecast would have been if forecast had been off the model using input available at time forecast was made.

^c Statistics based upon forecasts actually used.

^d E as a percent of mean price.

procedure is that you give decision makers reliable probability intervals around a given forecast. It is based upon actual performance and the decision maker has greater confidence in it than he would in one computed straight from the model. A second important advantage of the procedure is that errors for forecasts of different lengths of time into the future are accounted for. Standard errors of forecast are computed for each length of time into the future that prices are forecast. For example, the standard error of forecast for three months is computed from monthly price forecasts made three months in advance. These procedures and some results are discussed in the next section.

Some Results

In the early fall of 1970 we revised and updated our procedures and models for forecasting broiler prices. In this section we present some comparisons based upon forecasts made since October 1970. The forecasts were for USDA Grade A prices at Chicago.

In our forecasting we use both quarterly and monthly models. Forecasts made up to four months into the future are based primarily upon the monthly model. Forecasts four to six months are based upon both the quarterly and monthly models. Beyond six months only the quarterly model is used. The results below are based upon the quarterly forecasts only. Results for monthly forecasts are analogous.

Data in Table 1 show a comparison of two sets of forecasts. First is the model forecast. This is the forecast we would have made if we had taken our forecast straight from the model.

The model has an R^2 of .79 with a standard error of 0.96 cents per pound or 3.7 percent of the average price during the period over which the model was estimated. The second forecast compared is the use forecast. This is the forecast we actually used. It is based upon the results we get from the model, other analytical vehicles, and the judgment factors listed above.

Comparisons are shown for forecasts made one, two, and three quarters into the future. We consider a forecast one quarter into the future if the forecast is made when at least one month remains in the quarter. It can be argued that we are understating our error because we have access to some actual prices. However, if the user is aware of the definition, we do not violate the usefulness of the errors. In any event, the model versus used forecasts are compared on an equal time basis.

The comparisons made are on those factors we have found to be most meaningful in evaluating forecasting performance. First are the numerical sum and average of the errors. These indicate the degree of bias in the forecast. Next are the absolute sum and average. These provide the user with an indication of the magnitude of the error he can expect over time. E^2 and E are calculated to compute probability intervals around our forecast. (Probability intervals are computed by treating E as a standard error.) It is from E that we compute the probability of a price being in a certain interval. We next show the average actual price and the coefficient of variation based upon E . Finally, the number of forecasts is shown.

Outside the period of estimation the forecast

error of the model was less than the standard error of the model for forecasts made one quarter into the future. For forecasts made two and three quarters into the future the standard error of the model was less than that based upon forecasts computed outside the period of estimation.

For forecasts of one, two, and three quarters into the future the forecast error for the forecasts used was less than it would have been had we used exactly what the model gave us. In both the model and use forecasts the error, as expected, gets larger the farther forecasts are made into the future.

While not statistically different from zero, the sum of the errors is positive in all cases. Unlike the results in least squares estimation the "residuals" do not sum to zero. We have an optimistic bias.

These data are the type that are useful for decision makers. It gives them a solid review of our track record and a reliable indication of what to expect from a forecast. They can see if we have a tendency to overestimate price. They can appreciate the differences in the magnitude of error for forecasts made for differing lengths of time into the future.

As noted earlier monthly results were of the same nature. The above results illustrate three basic points we have made. First, the performance of the model outside the period of estimation may not be the same as the estimated results. Second, the standard error of the model is not a reliable indicator of the error to expect. Finally, forecasts of differing lengths into the future have different standard errors. We have found the method outlined above to be a reliable method of computing standard errors.

Concluding Observations

There is a limit to what models can do in terms of forecasting distant prices. A mistake often made is to use monthly models to forecast monthly prices for six or more months. A monthly model does not have such capability. In our forecasting we place greater reliance on our monthly models for forecasts up to four months in the future. Beyond that we place greater emphasis on the quarterly model. We do not calculate monthly estimates from the monthly model for months more than six months in advance. Different models should be used for forecasting different distances into the future.

Models should be updated as new information becomes available. It is impossible to

incorporate future structural changes into a model. Therefore, if not updated, models will tend to "wear out."

The degree of accuracy required or expected in a forecasting model and in forecasts is a function of (1) the nature of the price involved, (2) the importance of the particular commodity to a firm, and (3) the type of decision that is being made. There are some commodities for which it is extremely difficult to attain a high degree of forecast accuracy. If such is the case, one should not waste resources trying to get the "perfect fit," particularly if the commodity in question is not of particular significance to a company or if "good decisions" can be made through the use of a substitute vehicle such as the futures market. For example, if the decision is whether or not to hedge broiler production, a fairly wide error in forecast is acceptable because the futures market will at times be such that you can hedge production at levels that will still give you the odds you want. On the other hand, a decision to put hams in storage for Christmas sales requires greater accuracy for good decision making.

Finally, and most important, the logic of the forecast must be explained to the audience. Explain the forecast in terms of reference understood by the user. If the user works with a reference of year-ago prices, present your forecast, if possible, in this perspective. Tell the user what is different now and why. Only if the gap between researcher and user is spanned is a price forecast useful. If we as researchers attack real problems and present realistic results to decision makers, there is an almost insatiable demand for price analyses.

The essence of my position is that too often we have been more interested in techniques than problems. We have been more concerned with analyzing historical relationships for the purpose of using a given technique than we have with developing good price forecasting procedures. Except for a point of reference, historical prices are of little use to decision makers. Forecasts of future prices are needed with realistic levels and probability intervals.

Econometric models are a useful starting point for forecasting. However, if they are used with textbook rigor their use as forecasting vehicles will be disappointing, particularly in giving reliable estimates of prediction errors. Proper use of models requires a realistic recognition of the assumptions made, a knowledge of the market involved, and some evaluation of those factors not included in the model.

Combining Statistical Techniques with Economic Theory for Commodity Forecasting

WALTER M. MYERS

RESearch in price forecasting has attracted the attention of professional economists, but, by and large, such research has contributed little to practical decision making. Two basic reasons can be cited for this failure. First, price researchers have failed to define clearly specific real world problems of importance and to identify alternative solutions before undertaking analyses. Second, the preoccupation with estimating demand and supply relationships and interpreting their practical significance in terms of flexibilities or elasticities has led only incidentally to useful price forecasting.

In finding solutions for structural systems rather than solutions to specific management problems there is a tendency to:

- (1) Select estimating models or techniques solely on their ability to fulfill optimal statistical properties rather than on their ability to produce usable results in understanding the market structure or in forecasting future events.
- (2) Include or exclude variables on the basis of their contribution to the underlying statistical properties of the system rather than on whether or not they aid in the construction of useful forecasting models, e.g., their future values may not be known or forecastable.
- (3) Concentrate exclusively on a single mathematical or statistical technique rather than on a composite of techniques.

The major objectives of this paper will be, therefore, to outline a specific management problem involving significant price uncertainties and to demonstrate how we would combine conventional statistical and econometric techniques in reducing this uncertainty.

A Typical Pricing Problem

Variations in the price of slaughter hogs are typical of those observed in most agricultural commodities. For instance, during the past decade the average monthly price of slaughter barrows and gilts at seven markets ranged from

a high of \$28.25 per hundredweight in February 1970 to a low of \$12.65 per hundredweight in January 1960. Between January 1, 1960, and January 1, 1972, the average price received (paid) for a 220-pound slaughter barrow and gilt was \$42.26. The average deviation of prices from this mean, again in terms of a 220-pound hog, was \$8.11 per head.

Absolute price movement and the variation of prices about their mean are of concern to both hog producers and commercial meat packers. We have found, however, that these decision makers are more interested in knowing where hog prices will be at some future date and what, if any, production or purchasing alternatives are available for reducing the exposure to an unfavorable price move.

Since historical data are now available on live hog futures quotations, the problem can be further reduced to one of developing a six-month forecasting model and evaluating its success in identifying opportunities for hedging and forward coverage.

Formulation of a Price Forecasting Model

Over the years economists have produced a multiple of new techniques that can be used in model specification and estimation. The use of simultaneous equation processes and its concurrent emphasis on model building, for example; fitting procedures using recursive models, two- and three-stage least squares, limited information single equation fits, distributed lag models; and in recent years, spectral analysis have all been upheld as new developments which will aid in decision making.

Once the problem has been presented there is a need, therefore, for researchers to concentrate on narrowing the range of plausible model types. We have found that this can best be accomplished by gaining an understanding of the time-varying properties of the major series themselves. This we do by spectral analysis.

Power spectrum estimates

In an exploratory capacity the spectral analysis in the frequency domain permits a clearer understanding of what constitutes a significant pattern than does the conventional

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moving average correlogram or periodogram in the time domain. For example, if all of the variance in a series is concentrated in only one narrow frequency band, the power spectrum will appear as a single "spike" at that frequency (Fig. 1). The more narrow and discernible the "spike" or "spikes" the greater the likelihood that the series can be described by a sinusoidal function. At the other extreme (Fig. 2), if all frequencies contribute equally to the total variance, the power spectrum graph will be a horizontal line. A purely random series is suggested by this spectral configuration. This series will not contain cyclical, seasonal, or other deterministic components; it cannot be expressed as a finite, linear aggregation of previous values. Figure 3 shows a typical spectral shape.

The spectral density function was estimated over the period 1930 through 1971 for both the number of hogs slaughtered each month and the average price paid at eight major markets for

all slaughter barrows and gilts. The results of the estimates using 60 time lags are presented in their logarithmic forms in Figures 4 and 5.

The most noticeable characteristic is the visual significance of a five-year cycle in the number of hogs slaughtered each month. This finding disputes the results of previous research. For instance, Harlow [3] observed a four-year hog cycle and suggested influences within the industry as the determining forces. (Because of the space limitation we will not pursue the logic behind why this cycle could or even should exist.)

As we expected, the power spectrum of slaughter hogs does demonstrate relative peaks at the seasonal frequency and several of its harmonics. The peak at .083 cycles per month is representative of a 12-month cycle (i.e., $1 \div .083 = 12.0$) and the relative peak at .167 or a 6-month cycle.

Despite attempting several trend-removing

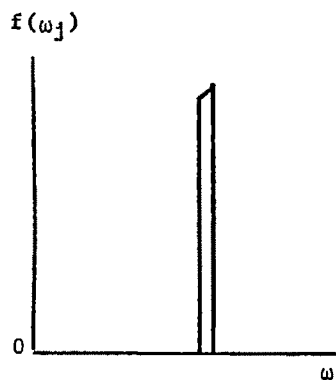


Figure 1. Spectrum of a sine wave

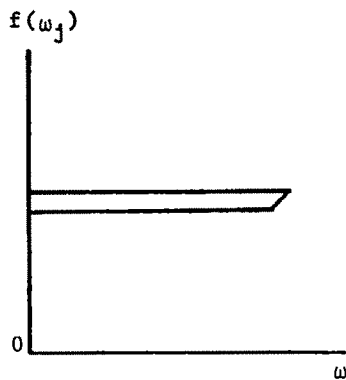


Figure 2. Spectrum of a purely random series

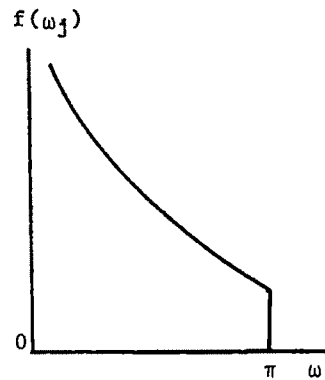


Figure 3. Typical spectral shape

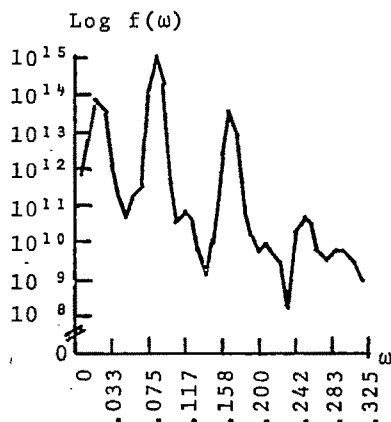


Figure 4. Log of spectral density of monthly hog slaughter

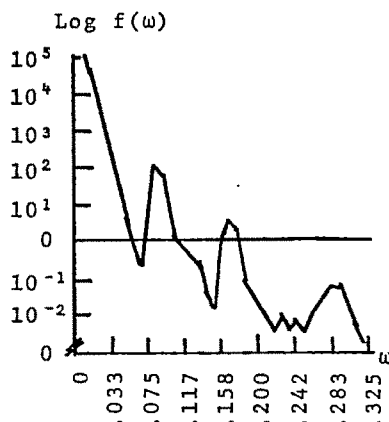


Figure 5. Log of spectral density of slaughter hog prices

transformations, the estimated spectral density of monthly hog prices is quite similar to those found in most economic time series. That is, the log of the spectral function is characterized by rapidly decreasing power at frequencies below .050 cycles per month and distinctive peaks at each of the so-called seasonal frequencies. Granger [2] submitted that power spectrums of this nature are suggestive of a process that can be represented by a low-order autoregressive function or a failure to remove appropriately the nonstationary properties of the series.

For our purpose in developing a forecasting model it can be concluded that (1) both the numbers of hogs slaughtered and the average prices paid for slaughter hogs follow extremely regular cycles, (2) the most significant for short-term analysis are the 12-month and 6-month seasonal cycles, and (3) either the transitory forces outside the hog industry or the biological and behavioral factors within the industry are primarily responsible.

The model

By combining the information from the power spectrum estimates with *a priori* knowledge of the economic behavior of the pork industry and previous published research [4], a four-equation system was developed. The system is recursive in that the dependent variable in each equation is treated as predetermined in succeeding equations. By placing emphasis on the previously exposed seasonal factors and eliminating behavioral variables that could not be forecast, simultaneous relationships between the variables in the system were minimized.

The following model was found to provide satisfactory forecasts, six months in advance, of average barrow and gilt prices:

$$\begin{aligned}
 (1) \quad \hat{H}_{it} = & -6019 + .07 F_{1t-6} + .45 F_{2t-6} \\
 & \quad (5.5) \quad (10.3) \\
 & + .105 F_{3t-6} + 1.15 F_{4t-6} \\
 & \quad (4.04) \quad (12.1) \\
 & + 149.3 \sin 30t^\circ - 355.7 \cos 30t^\circ \\
 & \quad (2.6) \quad (3.8) \\
 & - 212.8 \sin 60t^\circ + 12.76 T \\
 & \quad (4.0) \quad (9.5) \\
 & + 1012.6 WD_t \\
 & \quad (4.58) \\
 R^2 = .86 \quad d = 1.7
 \end{aligned}$$

$$\begin{aligned}
 (2) \quad \hat{C}_{it} = & 68.46 + .008 F_{ot-6} - 11.56 P_{ft-6} \\
 & \quad (1.4) \quad (2.89) \\
 & - 74.19 \sin 30t^\circ + .38 C_{st-12} \\
 & \quad (5.57) \quad (6.8) \\
 & + 3.44 T + 394.3 WD_t \\
 & \quad (4.03) \quad (8.46) \\
 R^2 = .85 \quad d = 1.4
 \end{aligned}$$

$$\begin{aligned}
 (3) \quad \hat{S}_{ht} = & -12.99 + .16 H_{st-1}/WD_{t-1} \\
 & \quad (6.8) \\
 & - .128 H_{st-2}/WD_{t-2} \\
 & + 18.02 \sin 30 + 20.97 \cos 30 \\
 & \quad (4.4) \quad (3.5) \\
 & + .004 F_{st-6} + 1.03 S_{ht-1} \\
 & - .18 S_{ht-2} \\
 R^2 = .94 \quad d = 2.07
 \end{aligned}$$

$$\begin{aligned}
 (4) \quad \hat{P}_{ht} = & 46.55 - .018 H_{st}/WD \\
 & \quad (18.6) \\
 & - .0068 C_{st}/WD - .022 S_{ht} \\
 & \quad (1.6) \quad (10.6) \\
 & + 127 T + .817 \cos 30^\circ \\
 & \quad (15.2) \quad (3.3) \\
 R^2 = .88 \quad d = .75
 \end{aligned}$$

Where:

H_s = U. S. federally inspected hog slaughter—number by month (1,000 head).

F_i ($i=1, 2, 3, 4$) = USDA's estimated barrow and gilt inventory by weight classification for slaughter market in the 10 major pork-producing states, as reported quarterly in the *Hogs and Pigs* report (1,000 head).

C_s = U. S. commercial cattle slaughter—numbers by month (1,000 head).

F_o = Cattle and calves on feed by weight classification in the 23 major beef-producing states, as reported quarterly in the *Cattle on Feed* report (1,000 head).

P_f = Average price per cwt. for Choice and Good grade 300–400 pound feeder steers—Kansas City.

S_k = Frozen and cured pork storage—U. S., beginning of month (million pounds).

F_s = USDA's estimated sows farrowing, 10 states (1,000 head).

P_k = Average price per cwt. for all slaughter barrows and gilts—seven markets combined.

WD = Number of fully utilized slaughter weeks within the month.

T = time (1963 = 1).

d = Durbin-Watson test statistic.

(\cdot) = t -statistic.

t = month.

Explanation of the Equations

Hog and cattle slaughter

Equations (1) and (2) relate the number of hogs and cattle slaughtered each month, respectively, to the number of feeder animals on farms during a previous period, the number of fully represented slaughter days each month, the 12-month ($\sin 30^\circ$, $\cos 30^\circ$) and the 6-month ($\sin 60^\circ$, $\cos 60^\circ$) seasonals, and a linear trend term.

The least squares regression coefficients in both equations are all statistically different from 0 at the 10 percent level and all agree with the economic theory with respect to the direction of influence. The d statistics of 1.7 and 1.4, respectively, indicate no positive autocorrelation in the residuals.

Observe that because of the loss of a degree of freedom it is not always necessary or even desirable to include trigonometric terms as reciprocal pairs. By applying a trigonometric identity, one gets

$$\alpha \cos \frac{360^\circ}{k} (t + t_0) = A \cos \frac{360t^\circ}{k} - B \sin \frac{360t^\circ}{k};$$

where,

$$A = \alpha \cos \frac{360t^\circ}{k},$$

$$B = \alpha \sin \frac{360t^\circ}{k},$$

$$\alpha = \sqrt{A^2 + B^2} = \text{amplitude},$$

$$t_0 = k/360^\circ \arctan B/A = \text{phase angle},$$

$$k = \text{period, and}$$

$$t = \text{month}.$$

And, if the least squares estimate of either \hat{A} or \hat{B} is found to be insignificant, then t_0 can be assumed to be either $k/2$ or 0 and the equation reduces to either

$$- \alpha \sin \frac{360t^\circ}{k} \quad \text{or} \quad \alpha \cos \frac{360t^\circ}{k}.$$

Frozen and cured pork stocks

Previous research [4] indicates a close relationship between frozen and cured pork stocks and the current prices of pork products, current pork production, and several seasonal factors. In equation (3) we have eliminated the influence of pork prices by hypothesizing that the "desired" stock level S_{kt}^* for a level of hog slaughter would be

$$S_{kt}^* = a_0 + a_1 H_{kt} + a_2 F_{s,t-8} + a_3 \sin 30t^\circ + a_4 \cos 30t^\circ.$$

Since this "desired" or equilibrium level cannot be directly observed, the equation

$$S_{kt} - S_{k,t-1} = \beta_0 (S_{kt}^* - S_{k,t-1})$$

will allow for an adjustment between what producers desire to place in storage and what was actually stored. We obtain the estimate in Equation (3) by substituting in for S_{kt}^* , adding a first-order autoregressive error scheme, and fitting by autoregressive least squares [1].

Slaughter barrow and gilt prices

The final equation contains the minimum number of variables found necessary to forecast slaughter hog prices adequately. The three supply variables (the number of hogs slaughtered, commercial cattle slaughter, and the absolute level of pork stocks), a linear trend term, and a 12-month seasonal will explain 88 percent of the total variance in slaughter hog prices. The standard error of this model at the mean is \$1.32 per cwt.

From a practical standpoint, actual values of the independent variables rather than calculated values were used in obtaining least squares estimates of the coefficients. The rationale for this is that in actual forecasting situations it is not uncommon for the researcher to adjust the calculated (forecasted) value of an endogenous variable before it enters the next step in the recursive system as a predetermined variable. Statistically, of course, if calculated values were used in fitting the equation, the least squares estimates would approach maximum-likelihood estimates.

The Durbin-Watson statistic of .75 indicates extreme positive serial correlation in the residuals. This finding is not surprising and can be attributed almost entirely to the effect of variables not included in the analysis.

Of major importance is the intentional omission of pork prices at either the wholesale or retail level as a determining factor. If the analyst knew either of these prices with some certainty, slaughter hog prices could simply be derived from it. Some improvement is observed by eliminating the linear trend term and including differing combinations of national in-

come, disposable consumer income, and population. However, it was found that the error involved in forecasting future values of these demand factors transcended their additional contribution to reducing the standard error in the equation.

Empirical Evaluation of the Model

Using historical data to evaluate a single theoretical system is extremely hazardous. Several reasons for this can be cited. First, internal statistical estimating properties are only meaningful within the sample period.

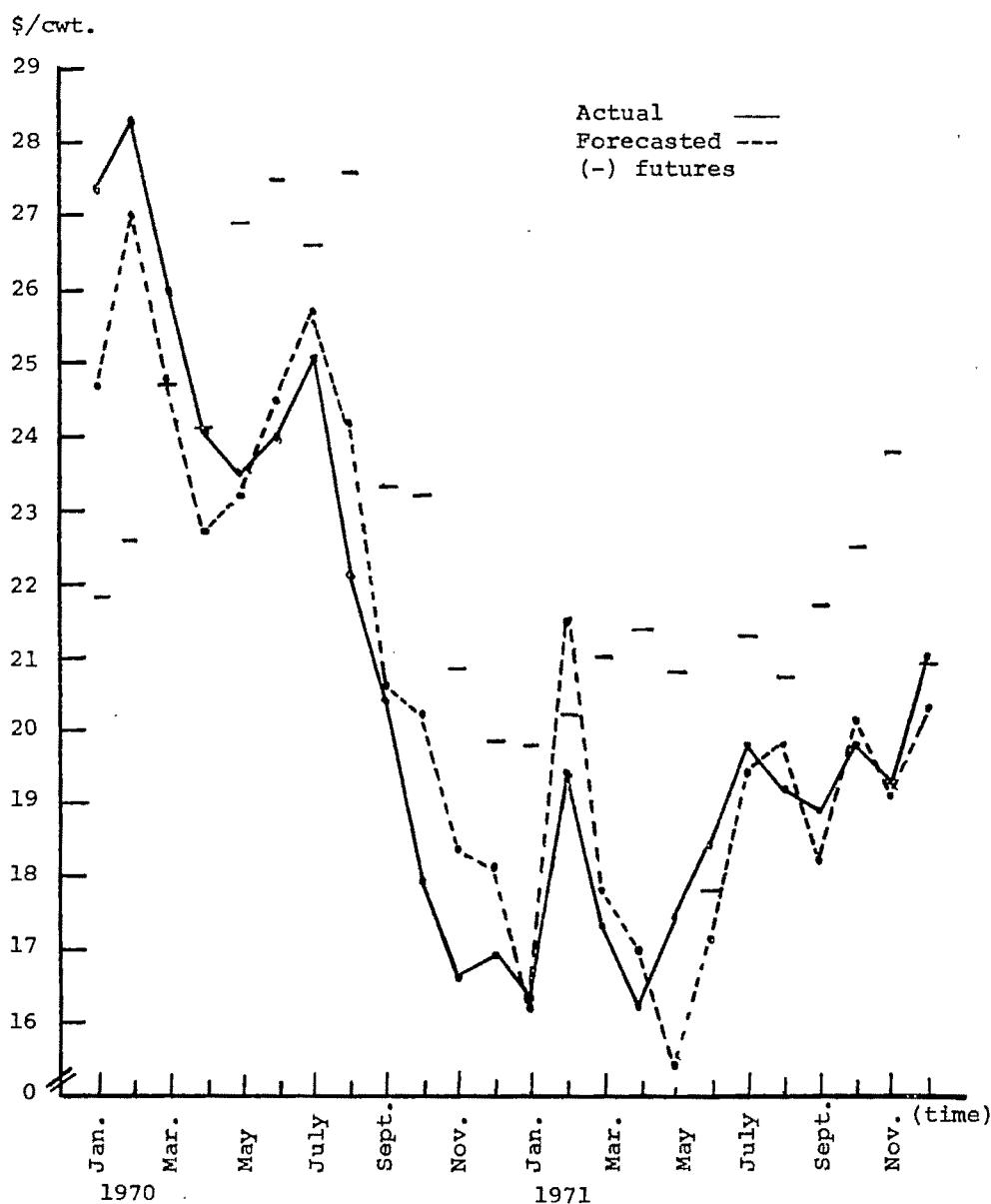


Figure 6. Slaughter hog prices

Second, models are fitted using actual revised data, whereas forecasts are based on published data subject to revisions. Third, and most important, historical evaluations are void of emotion; that is, forecasting models are not exact and, therefore, require some subjective judgment on the part of management.

Nevertheless, in order to provide some basis for evaluation, Figure 6 summarizes the success of the model in historically identifying hedging and coverage opportunities.

At the beginning of each time period (t) a forecast is made for the average price during the month ($t+6$). Correspondingly, the close of the live hog futures option that will terminate during the month, ($t+6$) for even-numbered months and ($t+7$) for odd-numbered months, is observed. If the forecast price is greater than the futures quotation, a long "coverage" position is recommended. Conversely, if the forecast is less than the futures, a short "hedge" position is suggested. In Figure 6 the solid line represents the actual average price for all barrows and gilts during time (t), the broken line denotes the forecasts for month (t) made six months previously, and the bars indicate the futures quotation on the day the forecast was made.

Example: On August 1, 1969, the February 1971 live hog futures contract closed at \$21.80 per cwt. The forecast average slaughter hog price for January 1970 was \$24.66 per cwt.—an expected increase of \$2.68 per cwt.

On the basis of the model alone an expected price increase of this magnitude would suggest that commercial meat packers "cover" all of their January requirements by buying February futures.

On January 15, 1970, the February 1970 option closed at \$28.35 for an increase of \$6.55. Observe from Figure 6 that although the actual price forecasting error was \$2.74 per cwt. (\$27.40 actual vs. \$24.66 forecast) the model did succeed in identifying the correct purchasing alternative. In the 24-month period represented in Figure 6 only two identification errors were committed—one in February 1971, the other in June 1971.

These forecasts were simulated under the ideal assumption that the predetermined variables were known with certainty. In actual applications these variables must, of course, be forecasted.

After a forecasting model has been developed, the only remaining task for management is the derivation of hedging and/or coverage rules that specifically apply to the working policy of their operation. For instance, by observing the performance of the model, probability ranges and "buffer" levels between the forecast prices and the futures prices can be established.

Conclusion

A substantial amount of resources has been applied to the development of new techniques for aid in decision making. To a great extent, however, the usefulness of techniques in price analysis by agricultural and business firms has been almost imperceptible. The primary reason for this is that published research is, by and large, oriented toward exposing and explaining the statistical properties of a new technique that should make it attractive to decision makers. However, research results which help management are not usually presented in the framework of a spectral analysis solution or a two-stage least squares solution. They are a composite of techniques plus subjective judgment and intuition on the part of the researcher.

In the problem associated with determining where hog prices would be at some future date and what, if any, marketing alternatives were available, a combination of spectral analysis, autoregression and multiple regression analysis, and a recursive system were used. By attempting to keep the equation within manageable proportions and yet produce useful information, several statistical properties either were violated or fell outside the bounds of conventional acceptability. In forecasting, however, a model can only be evaluated by its ability to provide adequate answers to pricing problems and only incidentally by its internal statistical properties.

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Allocation of Random Supply of Tomatoes of Varied Quality Produced in Different Areas Among Plants Producing Multiple Product Lines*

HARVEY H. S. KUANG

LINEAR PROGRAMMING has been used as a research tool in agricultural economics for 15 to 20 years and was employed prior to that in operations research applications. The general problem of linear programming was first developed and applied in 1947 by George Dantzig, Marshall Wood, and their associates in the Department of the Air Force.

Programming problems are concerned with the efficient use of limited resources to meet specified objectives. In effect, they involve the optimizing of a specific process which uses specified resources at known rates to make a specific product or meet an end objective.

The classic linear programming problem which determines the minimum total cost may be stated as follows:

Minimize the objective function

$$\begin{aligned} \Pi &= cX \\ (1) \text{ subject to } AX &\geq P_0 \\ X &\geq 0 \end{aligned}$$

where c is a row vector $(C_1, \dots, C_i, \dots, C_n)$ and C_i is the cost per unit of resource i ; X is a column vector $(X_1, \dots, X_i, \dots, X_n)'$ and X_i is the amount of the i th food item or resource used; P_0 is a column vector $(P_{01}, \dots, P_{0i}, \dots, P_{0m})'$ and P_{0i} is the minimum level of a nutrient or the minimum quantity of a product in order to satisfy a demand; and A is a $m \times n$ matrix,

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix},$$

and a_{ij} is the content of nutrient i per unit of the j th food item or the amount of the j th resource required to produce one unit of the i th product.

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The problem as indicated by the title of this report is actually the familiar transportation problem other than the objective function. The transportation problem is a special case of the general linear programming problem where one's objective is to minimize the total shipping cost while meeting all the shipping requirements and restrictions. The definition of the classical transportation problem is the same as in (1) except that the elements a_{ij} of A take on the values of either 1 or 0 [1, 5].

Basic to the solution of the linear programming problem is the assumption that the coefficients c , A , and the constraints P_0 are known and constant. In many practical applications of linear programming techniques these coefficients and constraints are not known and must be estimated. The development of stochastic linear programming techniques is a clear indication of the general awareness of the problem. Stochastic linear programming methods do help in seeking solutions to problems with certain types of risk factors [3, 4, 6]. Little has been said about the stability and other qualities of the solutions. This paper reports on how this problem in applying linear programming was overcome in one practical application. The work reported here was carried out in late 1966 and early 1967.

The Problem

Tomato processors typically purchase their raw product requirements on a contractual basis whereby the grower is paid a fixed price per ton for the fruit delivered to the processor. The price paid to the grower is clearly an important factor in finished product costs. Two other elements which are important determinants of finished product costs are the transportation costs incurred in moving raw product to the processing plant and the yield of finished product per ton of raw product utilized.

Through research carried out both in industry and at the University of California, it has been determined that there are measurable physical and chemical characteristics of raw product tomatoes which can be used to predict the finished product yield of a given lot of

tomatoes used in the various finished products such as sauce, ketchup, paste, puree, etc. While the potential yield difference of various fields of tomatoes is not sufficient to overcome the transportation cost involved in moving fruit long distances, it is sufficient to make optimum use of the tomatoes produced in a given area attractive. Given the fact that Hunt-Wesson has four tomato canneries in northern California, each of which produces a different mix of finished products, the potential for gain through optimum use of raw fruit appeared to be present.

Definition of the problem

The specific problem considered is as follows:

Maximize the objective function (or minimize its negative):

$$(2.1) \quad \Pi = \sum_{ij} x_{ij} E(v_{ij}),$$

$$i = 1, \dots, m \text{ and } j = 1, \dots, n$$

Subject to:

$$(2.2) \quad \sum_i x_{ij} \leq b_j, \quad j = 1, \dots, n$$

$$(2.3) \quad \sum_j x_{ij} \leq a_i, \quad i = 1, \dots, m$$

$$(2.4) \quad \sum_i a_i = \sum_j b_j = B$$

$$(2.5) \quad x_{ij} \geq 0, \text{ for all } i \text{ and } j,$$

where x_{ij} is the quantity of tomatoes delivered by a grower on a given day from field i to plant j ; $E(v_{ij})$ is the expected value of v_{ij} , which is the value of a ton of fruit delivered to plant j from field i ; b_j is the processing capacity restrictions at plant j ; a_i is the delivery restrictions in field i ; B is all the fruits delivered from all the fields and to all the plants; and m is the number of fields and n is the number of all the plants. Now, there is a need to define $E(v_{ij})$ and discuss the meaning and justifications of the constraints a_i and b_j .

The value of tomatoes to a processor

On a given day the levels of activities scheduled for the various production lines determine how the fruit is utilized at a processing plant. During the day the arrivals of the loads of tomatoes at the plant are more or less random. All the fruit when received is mixed. If at plant j there are l production lines and p_k percent of all the fruits received are made into product k ,

then a load of tomatoes harvested from field i would have a chance of p_k percent of being used to make product k at plant j . Let w_k denote the estimated value per standard case of product k and Y_{ik} denote the case yield of a ton of tomatoes to be harvested from field i and processed to make product k in its entirety. Then the expected value of this ton of tomatoes can be expressed as:

$$(3) \quad E(v_{ij}) = \sum_k p_{jk} w_k y_{ik} - c_{ij},$$

for all i and j ,

where c_{ij} denotes the net per ton shipping costs from field i to plant j .

Since total processing volume during a given season is determined on the basis of such factors as beginning inventory levels and the estimated sales volumes of the various products at contracting time and is limited in the end by the actual output which is also a function of weather conditions, among other things, fixed costs of a corporate of multiple groups of products are not important considerations in the evaluation of individual products in the short run. The value of a case of product k , w_k , to a corporation in the short run can be fairly accurately reflected by setting it equal to the estimated selling price, f.o.b. plant, minus the various costs which include the cost of raw material, packaging materials, seasonal labor, etc. Shipping costs are not netted out because they are given separate treatment in the problem.

The manufacturing yield of product k from a ton of tomatoes harvested from field i is determined by the physicochemical properties of the fruits, i.e., raw solids content and viscosity:

$$(4) \quad Y_{ik} = f_{ik} \{ (\text{raw solids content})_i, (\text{viscosity})_i \},$$

for $i = 1, \dots, m$ and $k = 1, \dots, l$.

Harvest restrictions

In modern commercial tomato farming, rising labor costs and other labor-related difficulties have caused growers to rely more and more upon farm machinery to perform many farm operations. The recent advent of the tomato harvester and the successes in developing new varieties of tomatoes whose fruit ripens more uniformly have considerably shortened the harvest period. To have the best qualities of the fruit preserved, harvest must be carried out when a minimum of 70 to a maximum of 90

percent of the fruit is ripe in a given field. This means there is only a period of seven to ten days suitable for harvest in any field, depending upon variety, weather, and field conditions. This means that the quantity of raw product available on a given day is controlled by harvest conditions and must be taken as datum. What a grower delivers each day is a restriction. Consequently, the total tomato values are to be maximized on a daily basis.

Processing capacity restrictions

Production line specialization, corporate year-end inventory positioning, urgency of current marketing requirements and annual marketing planning, the desire for minimum short-term fluctuations in the plant processing activity levels, etc., determine the levels of activities on each production line and, taken together, the overall processing capacity of a given plant on a daily basis. Thus, the processing capacity of each plant on a given day is also a restriction.

Solution

The estimate of v_{ij} has the expected value $E(v_{ij})$. Since $E(v_{ij})$ is a constant, the solution to problem (2) can be obtained in the usual manner. According to Saul I. Gass [3], the transportation problem always has a finite minimum feasible solution since the coefficients in the restrictions (2.2) and (2.3) are all positive and the restrictions a_i and b_j are finite. Further, if a_i and b_j are non-negative integers, then every basic feasible solution, and therefore, the optimal solution, has integral values.

Implementation

Before this allocational program is put to use out in the real world on a day-to-day basis, two things need to be established: (1) the program can be fairly easily implemented; and (2) carrying out the program will yield significant and reliable economic gains over the one already in use which minimizes the total shipping costs.

Capability of being implemented

As mentioned earlier, Hunt-Wesson Foods, Inc., has four tomato processing plants in northern California, two at Hayward, one at Oakland, and one at Davis. In an average year there are more than 40 growers producing tomatoes for the company under contracts in an area extending as far as 175 miles from an individual plant. The company maintains a field

office in Hayward, which is in charge of, among many other things, coordinating grower and processing plant activities during harvest time so that the fruit flows from the fields into the processing plants in the most desirable manner.

The field office manages the flow of fruit based on the following information: (1) estimates by the growers of the amounts of tomatoes to be harvested and delivered from each field on a daily basis; (2) estimates by the plants of the volume of tomatoes to be processed on a daily basis. This information, together with the cost structure of transportation, would be sufficient for decision making if the objective is to minimize total shipping costs. In order to maximize the total value as defined in the problem, more information would be required: (1) the relative activity levels at the production lines within the processing plant on a daily basis; (2) estimates of the physicochemical quality indices of the tomatoes to be harvested from each field; and (3) other price and cost data. All this information must be received sufficiently in advance so that (1) computations can be made and solution reached, and (2) on the basis of the solution, instructions can be issued to growers before the execution day on how much each of them should ship from each field to each plant.

When the execution day arrives, if all data on which the allocation plan is based remain unchanged, then the allocation will be executed according to plan, and the actual will be the same as the planned allocation. In that case everything is perfect. However, in an operation involving so many people and so much equipment, unforeseeable events do occur at times on the very execution day so that changes to the inputs have to be made and consequently the plan must be modified to accommodate such changes. For example, a grower may not be able to harvest in a given field if a rainstorm comes suddenly or his equipment breaks down. The amount of tomatoes a grower harvests may be more or less than he first estimated. Also, a plant may not be able to operate a production line because of machinery breakdowns, etc. Usually, when the field office is informed of such changes, there would not be enough time to go to the computer for a revised solution and execute the day's allocation on the basis of the revised plan. Fortunately, past experience shows that the number of such changes is usually small. Further, since the field office is manned by personnel who have a sound knowledge of

linear programming, quasi-optimal adjustments can easily be made by use of the slack variable technique and some simple rules. Experiments by way of simulation indicate that the "essence" of the original plan can be adequately preserved after adjustments are made to accommodate for input data changes. This implies that the type of changes in a_i and b_j for the problem considered here would not cause serious difficulties.

Evidence of economic gains

After the problem is defined and the rules and procedures for implementing the allocation program are all set up comes the question of dollars and cents. As mentioned earlier, this value-maximizing program, as opposed to the shipping costs-minimizing program, requires much extra work and therefore extra expenses. For example: the physicochemical qualities of the tomatoes have to be measured field by field, entailing increased sampling and laboratory test work. The value-maximizing allocation will most likely not be the same as the shipping cost-minimizing allocation, implying there will be additional out-of-pocket trucking costs. There are, of course, additional administrative and other expenses. All this extra money will be spent in exchange for an expected or theoretical gain in the form of higher manufacturing yields. In order to make the decision to carry out such a program, convincing evidence of significant gains must be established first.

Suppose X_v is the solution to the value-maximizing problem, and X_c is the solution to the shipping cost-minimizing problem. The value of the objective function Π as defined in (2) at solution X_v is then $\Pi(X_v)$ and at solution X_c is $\Pi(X_c)$. The difference $\Pi(X_v) - \Pi(X_c)$ can be used as a fair approximation of the economic gains of the allocation based on value-maximization over the one based on shipping cost-minimization, since the latter has been in use and the former is being considered as a potential substitute. This difference is non-negative and its size depends on (1) the objective function Π itself and (2) how similar or dissimilar the solutions X_v and X_c are. If (1) the tomatoes are uniform in terms of their physicochemical qualities, (2) all the plants operate exactly the same production lines and each line processes exactly the same share of the total plant volume, or (3) the tomatoes have non-uniform qualities but their geographical distribution is such that the

value-maximizing allocation completely satisfies the shipping cost-minimization problem, then the two solutions would be identical and the economic gains equal zero. Experience and knowledge show that (1) and (2) are not true and (3) is not probable.

In order to gain some insight into the size of this potential economic gain, one allocation day—September 28, 1966—was chosen at random. All the necessary information was gathered, estimates were made, and on the basis of these estimates the maximum value solution was obtained; call it $E(X_v)$. A total of 166 20-ton truck loads of tomatoes was included. On the allocation day, however, some of the information and estimates were revised, and adjustments to the solution $E(X_v)$ were then made accordingly by use of the rules set. A total of 122 20-ton truck loads of tomatoes was actually involved on the day. The total value of the solution $E(X_v)$ after adjustments was calculated at \$183,756.40, equivalent to \$75.31 per ton. But the fruits were actually allocated in such a way to minimize the total of trucking costs; in other words, X_c was actually implemented. The total value of the solution X_c , $\Pi(X_c)$, was calculated at \$183,657.60, equivalent to \$74.04 per ton. The difference in value between these two allocations amounted to \$3,098.80, equivalent to \$1.27 per ton or 1.72 percent. Based on the final data, the maximum value solution, X_v , was obtained. Had all the final data been known during planning, this solution would have been used as the planned allocation. It is the best possible allocation. Its total value was calculated at \$185,000.80, equivalent to \$75.82 per ton. So the potential maximum economic gain is reflected in the difference $\Pi(X_v) - \Pi(X_c)$, which was calculated at \$4,343.20, equivalent to \$1.78 per ton or 2.4 percent. These gains are certainly economically significant. By this two-stage allocation method, i.e., from the maximum value solution based on estimates to the modified maximum value solution due to changes in the estimates, \$1.27 or 71.3 percent out of the potential maximum economic gain of \$1.78 per ton could be realized.

Reliability of economic gains

By now the question must be raised as to how reliable the economic gains can be, given that they are considerable. This question is particularly relevant in view of the fact that the values as specified in relation (3) are calculated

on the basis of the manufacturing yields which, in turn, as described in relation (4), are calculated on the estimated indices of the physico-chemical characteristics of the tomatoes to be allocated. Further, the measuring and sampling errors in these estimates can be so large as to upset the entire economic gains, which are highly sensitive to changes in the quality indices. For example, the production of a tomato paste product of 30 percent raw solids content requires 20 percent more tomatoes with 5 percent raw solids content than those with 6 percent raw solids content on a net weight basis. The normal range of raw solids content of tomatoes is between 5 and 6 percent. One percent difference in raw solids content means a value difference of \$11 or more to a ton of tomatoes processed. As another example, the manufacturing yield in terms of standard cases of tomato sauce product vary from 25 to 33 over the more or less maximum range of the viscosity values of tomatoes. Every case yield of sauce product has a value of around \$3 to a ton of tomatoes processed. The values quoted here reflect the then prevailing market conditions.

Experience shows that the measuring and sampling errors are negligible in the estimation of raw solids content but are large enough in the estimation of the viscosity of tomatoes to cause concern about actually using it as a basis for the allocation of tomatoes. Repeated testings have been carried out to establish that the measuring and sampling errors in the estimation of the viscosity of tomatoes, when translated into standard case yield of tomato sauce products per ton of raw tomatoes, are more or less normally distributed with mean equal to zero and standard deviation equal to one.

Three questions must now be answered: (1) Would measuring and sampling errors of this kind be sufficient to cause serious misallocation of fruits under the value-maximizing program? (2) Could the value of a solution be fairly accurately assessed? (3) What would be the effect of the errors on the economic gains?

(1) Effect of errors on allocation.—In seeking to answer the question just raised, repeated experiments were carried out to simulate what degree of changes would result in the value-maximizing solution when random normal errors, with mean equal to zero and standard deviation equal to one [2], were introduced to the estimated standard case yield numbers. Five sets of random normal errors were intro-

duced. With other things remaining unchanged, five sets of coefficients, $E(v_{ij})$, of the objective function were generated. These, together with the original set, gave a total of six sets. For ease of discussion, let the original set be denoted V_1 and the others V_2, \dots, V_6 . Corresponding to each V_i there is an objective function Π_i ; and, by using the final data on constraints, a maximum value solution, $X_{v,i}$, and a value of the objective function at the solution $X_{v,i}$, $\Pi_i(X_{v,i})$. These new value matrices should not cause changes in the shipping costs-minimization solution, X_c . They would give new evaluations of the solution X_c , however. Corresponding to each V_i there is a $\Pi_i(X_c)$.

Results showed that the solutions $X_{v,2}$ to $X_{v,6}$ differed little from the original solution $X_{v,1}$. Compare each of the solutions $X_{v,2}$ to $X_{v,6}$ against $X_{v,1}$. Out of the tomatoes from the 46 different fields, none of the solutions called for changes from the original involving more than six fields and some of the changes involved only part of the tomatoes delivered from a field. The total number of fields where allocational changes were called for was 12. One of the 12 fields had allocational changes in four of the five alternative solutions, three of them in three, two of them in two, and six of them in one. There were altogether 23 such changes. One could conclude on the basis of these that most of the changes occurred in the marginal cases.

Additionally, if all value-maximizing solutions differ from one another only in the "marginal" shipments, then the values of these solutions under a given evaluating system, Π_i , shall not differ from one another by more than "marginal" amounts. Based on each of the six objective functions, the calculated values of the six value-maximizing solutions and the transportation cost-minimizing solution are as shown in Table 1. It is clear that the differences among the calculated values of the value-maximizing solutions are quite small.

Further, if V_i is the true value matrix, the maximum value solution is $X_{v,i}$. Every other solution $X_{v,j}$ is an inferior solution, for

$$(5) \quad \Pi_i(X_{v,i}) - \Pi_i(X_{v,j}) \geq 0, \quad \text{for } i \neq j.$$

In the real world, the true value is seldom known. The solution resulting from the estimated value matrix most likely will be less than optimal. Thus for each V_i the differences calculated by (5) demonstrate the degree of fruit misallocation for not being able to obtain a

Table 1. Total value of solutions X_0 and X_{01}, \dots, X_{06} in terms of each of value matrices V_1 through V_6 in thousands of dollars*

Solution	Value Matrix					
	V_1	V_2	V_3	V_4	V_5	V_6
X_0	180.7	182.1	180.6	181.5	179.9	181.1
X_{01}	185.0	186.1	185.3	186.2	183.8	185.1
X_{02}	184.9	186.4	185.3	186.2	183.6	185.1
X_{03}	185.0	186.4	185.4	186.2	183.5	185.1
X_{04}	185.0	186.4	185.3	186.3	183.8	185.1
X_{05}	184.9	186.3	185.2	186.1	184.7	185.1
X_{06}	184.6	186.2	185.1	186.0	183.6	185.2

* These numbers are rounded out.

solution on the basis of the true value matrix. In column j of Table 1, the j th and the largest number represent the correct valuation of the best possible solution, provided the true value matrix is V_j . The difference between this number and each of the other numbers in the same column shows how seriously the tomatoes can be misallocated in each case. The results here clearly show that measuring and sampling errors of the type specified earlier would not cause serious misallocation when the maximum value solutions are used as a basis. In fact, the most serious one, found in column 5, involved a difference in total value of \$1,224.40, equivalent to 50 cents per ton. In sharp contrast, the extent of fruit misallocation represented by the minimum shipping cost solutions is quite serious. The least serious one involved a difference in total value of \$4,121.20, equivalent to \$1.69 per ton, which is in column 6.

(2) **Effect of errors on the value of a solution.**—Consider the realistic case where V_i is used in obtaining the solution X_{0i} , but the true value matrix is V_j . Obviously, there does not exist a fixed relationship between $\Pi_i(X_{0i})$ and $\Pi_j(X_{0i})$. The difference between $\Pi_i(X_{0i})$ and

$\Pi_j(X_{0i})$ reflects errors in evaluating the solution X_{0i} due to the sampling and measuring errors in estimating the case yield of the tomatoes. So, for each solution X_{0i} , the different values $\Pi_j(X_{0i})$ do shed some light on the extent to which errors can be made in evaluating a given solution. The numbers in row i of Table 1 show how much the valuations of the solution i can vary. The results here definitely indicate that correct valuation of any solution is difficult.

Finally, if V_i is the estimated value matrix which generates a solution X_{0i} , but the true value matrix is V_j and the truly best solution is X_{0j} , then the difference $\Pi_j(X_{0j}) - \Pi_i(X_{0j})$ would reflect both errors in valuation and misallocation. As can be seen from results in Table 1, this difference can be both positive and negative.

(3) **Effect of errors on the economic gains.**—As discussed earlier, whichever is the real value matrix, the degree of tomato misallocation as reflected by the minimum shipping cost solution was by far more serious than that reflected by any of the maximum value solutions. In fact, given the real value matrix, measuring and sampling errors of the sort specified earlier

Table 2. Simulated gains in total value of solutions X_{01} through X_{06} , respectively, over solution X_0 in allocating 2440 tons of tomatoes, in dollars*

Solution	Value Matrix					
	V_1	V_2	V_3	V_4	V_5	V_6
X_{01}	4340.6	3953.5	4713.1	4731.0	3950.6	4103.0
X_{02}	4246.3	4310.9	4721.9	4700.9	3694.8	4065.2
X_{03}	4282.4	4247.7	4780.7	4705.7	3596.2	4032.2
X_{04}	4322.7	4275.2	4722.3	4812.6	3913.5	4018.8
X_{05}	4250.0	4214.7	4549.7	4637.0	4820.8	4049.8
X_{06}	3971.6	4041.0	4461.8	4529.0	3742.8	4121.2
Average	4235.6	4173.9	4658.3	4886.0	3953.1	4065.0

* These numbers cannot be arrived at by using the numbers in Table 1 because of rounding.

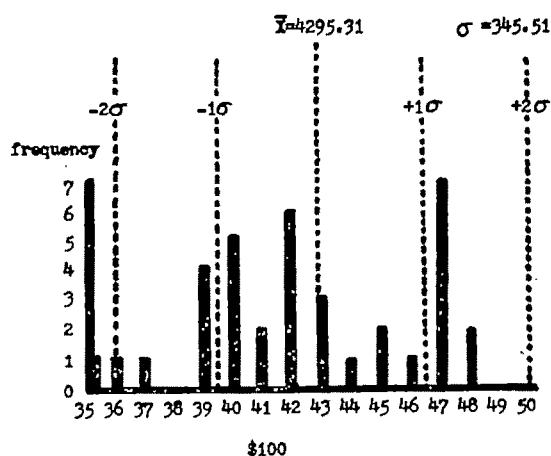


Figure 1. Frequency distribution of the simulated economic gains in total values

could cause the estimated value matrix to differ from the real one and lead to some solution which is less than optimal. Actually, all these maximum value solutions, including the truly optimal, have more or less the same chance of being used as a basis for actual fruit allocation. Insofar as these simulated results can demonstrate here, all the maximum value solutions are by far superior to the minimum shipping cost solution. So, under each value matrix V_i , the differences

$$(5) \quad \Pi_i(X_{vj}) - \Pi_i(X_o), \quad \text{for all } j$$

can be used to approximate the extent of economic gains, given the sort of sampling and measuring errors that are present in the system. These differences are calculated as shown in Table 2. The maximum difference is \$4,820.80, equivalent to \$1.98 per ton, while the minimum is \$3,596.20, equivalent to \$1.47 per ton. The overall average is \$4,295.31, equivalent to \$1.76 per ton.

The frequency distribution of the simulated economic gains is presented in Figure 1. It has a

mean of \$4,295.31 and a standard deviation of \$345.51. Twenty of the 36 simulated values fall within the range of mean plus and minus one standard deviation.

It is fairly safe now to conclude that the economic gains in allocating tomatoes based on a maximum value solution, given the type of measuring and sampling errors as specified earlier, over that based on a minimum shipping cost solution are not only significant in size but also quite reliable. In particular there is no need for the concern that the use of the maximum value approach toward tomato allocation may cause serious misallocation.

Summary and Conclusion

Linear programming is a valuable tool for decision making in many areas. The fact that some or most of the coefficients and constraints are probabilistic does present a problem. In a stochastic case reliable knowledge about the probability distribution of the coefficients will be immensely valuable, although one cannot directly derive from it the stability and other statistical qualities of the linear programming solutions. As demonstrated in this study, such knowledge can be used as a basis to simulate the solutions to the problem and establish a measure as to the general qualities of the solutions. For the problem on hand the results established that, given the type of measuring and sampling errors in the estimates of the tomato qualities, the value-maximizing approach was superior to the transportation cost-minimizing approach. The conclusion was to implement the maximum value approach. This is not a general rule, however. Had the errors been of a different type, the same conclusion might not have been reached. Thus, in applying linear programming to real world problems, one must be extremely careful to substantiate the fact that the data used in obtaining a solution are sufficiently stable to provide a stable solution.

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An Industrial Perspective on Agricultural Policy in the 1970's

WILLARD R. SPARKS

SINCE Cook Industries, Inc., is a large grain exporter, our main interest as far as farm policy is concerned is related to the major commodity programs. We worry about sugar programs, etc., but we really spend many days and hours trying to analyze the effects of various commodity programs or what the farm programs will be in the following year. For example, what will the 1971 Act mean to the feed grain, wheat, and cotton farmers under varying price situations?

If the Russians buy corn and wheat and wheat prices move up to \$2.00 a bushel, will the farmer respond and overplant his wheat acreage allotment, or will he divert land under the voluntary program and restrict wheat acreage?

We continue to examine the implications of various programs and measure world supply and demand within these various sets of assumptions. I would like to see the agricultural economics profession become concerned about U. S. farm policy in such a way as we become concerned with some of the macro problems of various areas. In the United States many millions of dollars are spent in various projects around the U. S. Don't get me wrong—these are very important projects and they may solve a number of problems for the people who live in these areas. But in terms of what affects net farm income, they have little meaning, but that does not mean we should not do them. What are the items that really affect farm income? How much attention are GNP, Balance of Payments, etc., given by the agricultural economic profession? Research in the macro economic area is one of the most wide open I have ever witnessed. I have never seen an area of agricultural research in which the contribution could be so large and an area which such a few agricultural economists really understand. (I would say that not 10 percent of the people at this convention really understand the commodity programs or how they function.)

What will be the impact if Russia buys 450 million bushels of wheat? How will this recent purchase affect farm income and the economy

in the wheat area? One of the major problems facing the policy and agricultural economists is the lack of understanding regarding our grain marketing system.

Rather than spending a lot of time on how various trades take place, let's look at the opportunities for the agricultural economics profession in policy implication and formulation. How are farm programs administered, how is farm legislation written, and how does the land grant university fit into this puzzle?

As an example of the problems faced in writing new legislation and administering farm programs, let's look at the recently passed Agriculture Act of 1971 and the 1972 commodity programs.

I have followed this Act very closely, and to the best of my knowledge, there were only five or six agricultural economists outside the USDA who either encouraged or discouraged the passage of this legislation. The 1971 Agriculture Act was primarily written by politicians and economists in the USDA and by politicians in the Congress. Because of the hard work of four or five key people in the USDA we have a commodity program that is very market oriented.

The Act made a major move to a market-oriented program in the cotton economy by removing the mandatory control of acreage. The cotton farmer has the option of responding to conditions as indicated by the market, as he is doing in 1972.

Once we get legislation, then what happens? Who administers that legislation? Who makes the decisions of whether we need to increase wheat acreage or decrease wheat acreage, increase soybean or corn acreage? We see reams and reams of LP analysis on how farmers respond under various assumptions, but we do not see (or I do not see) in these analyses what will really happen to soybean acreage if we have a cotton set-aside of 28 percent.

The decision that faced the USDA in the fall of 1971 regarding the 1971 Feed Grain Program was an interesting example of the difficulty in making year-by-year decisions regarding feed grain production. (As an example of the difficulty facing the administrator of the farm program, let's look at the 1972 Feed Grain

Table 1. Soybean balance table (million bushels)

	1968-69	1969-70	1970-71	1971-72	1972-73*
Carry-in	166	324	229	99	72
Production	1103	1126	1124	1169	1270
Total Supply	1269	1450	1353	1268	1342
Crush	606	737	760	717	714
Export	287	431	433	412	489
Seed & Residual	52	53	61	67	71
Total Usage	945	1221	1254	1196	1274
Carry-out	324	229	99	72	68
Harvested Acreage (Mil. Acres)	41.4	41.0	42.0	42.4	45.8
Yield Per Acre (Bu.)	26.8	27.5	26.7	27.6	27.7

Source: United States Department of Agriculture

* Usage data are author's estimates.

Program.) When the 1972 Feed Grain Program regulations were announced, everybody was too concerned about a 5.5 billion bushel corn crop. This large crop of 1971 had introduced an unexpected factor in the 1972 feed grain decision. How were we going to get the corn price up from the \$1.00 per bushel of the fall of 1971? The fall election of 1972 and inflation made it necessary that we have higher prices in 1972 than experienced in 1971. Thus, many of the 1972 program regulations were made based on political rather than economy decisions. In order to induce a cutback in production, the feed grain payments were increased about \$1.2 billion. By adding another \$1.2 billion to the feed grain payments, the USDA was able to induce the feed grain farmer to reduce his corn acreage and therefore tighten supply in order to move prices up.

Although this feed grain decision was made to reduce corn production, it also had a major

impact on soybean acreage. Since soybeans are a major competitor with corn and set-aside for land, any changes in the payments for set-aside acreage or corn prices have a major influence on soybean acreage. A major amount of research is needed to determine the response of soybeans under various alternative feed grain programs.

The recent purchases by Russia have made a major change in the problems facing us in the 1973-74 crop year. Our problem becomes one of stimulating production rather than trying to sell our surplus. In Tables 1, 2, 3, and 4, we have balance tables for corn, wheat, grain sorghum, and soybeans.

We are forecasting a very small 1973 beginning inventory for each of these crops.

What demand estimates should be used for 1973-74? Will farmers respond to the high prices that currently exist and increase production?

Corn usage is estimated at 5,650 million

Table 2. Wheat balance table (million bushels)

	1968-69	1969-70	1970-71	1971-72	1972-73*
Carry-in	539	819	885	730	865
Production	1576	1460	1370	1640	1543
Total Supply	2116	2282	2256	2371	2409
Flour	507	508	506	512	508
Seed	62	57	63	63	58
Exports	544	607	739	632	1078
Other	184	225	217	297	203
Total Usage	1297	1397	1525	1504	1847
Carry-out	819	885	730	865	562
Harvested Acreage (Mil. Ac.)	55.3	47.6	44.1	48.4	47.9
Yield Per Acre (Bu.)	28.5	30.7	31.0	33.8	32.2

Source: United States Department of Agriculture

* Usage data are author's estimates.

Table 3. Corn balance table (million bushels)

	1968-69	1969-70	1970-71	1971-72	1972-73*
Carry-in	1162	1113	999	663	1117
Production	4393	4583	4099	5540	4948
Total Supply	5555	5696	5098	6203	6065
Feed, Seed & Residual	3551	3729	3564	3961	4128
Exports	371	598	501	748	840
Industry	520	370	370	377	377
Total Usage	4442	4697	4435	5086	5345
Carry-out	1113	999	663	1117	720
Harvested Acreage (Mil. Acres)	55.9	54.6	57.2	63.8	57.1
Yield Per Acre (Bu.)	78.6	83.9	71.6	86.8	86.6

Source: United States Department of Agriculture

* Usage data are author's estimates

Table 4. Grain sorghum balance table (million bushels)

	1968-69	1969-70	1970-71	1971-72	1972-73*
Carry-in	289	288	245	91	172
Production	740	747	696	895	803
Total Supply	1029	1035	941	986	975
Domestic Usage	638	672	688	722	735
Exports	103	121	162	92	137
Total Usage	741	793	850	814	872
Carry-out	288	245	91	172	103
Harvested Acreage (Mil. Acres)	14.0	13.5	13.7	16.6	14.0
Yield Per Acre (Bu.)	52.9	55.3	50.7	53.9	57.5

Source: United States Department of Agriculture

* Usage data are author's estimates.

bushels in 1973-74, an increase of almost 300 million bushels, and we also anticipate a need to increase the carry-out by at least 300 million bushels. Therefore, we see a need for at least an additional 600 million bushels in 1973-74 or about 7 to 8 million acres. An additional 3 million acres is needed in the grain sorghum area. Wheat usage in 1973-74 will certainly drop unless Russia has a second crop failure. However, we see the need for an additional 4 to 6 million acres of wheat in the Hard Red Winter area.

Soybean usage has been rationed in each of the last two years because of supplies and will be again in 1972-73. We anticipate a demand of 1,475 million bushels in 1973-74, an increase of 200 million bushels. This would result in an increase of almost 8 million acres.

In total for these four commodities, we see a need for an increase of 23 to 25

million acres in 1973-74.

USDA officials have a tremendously big problem and must decide between now and early November what kind of farm programs we are going to have in 1973. Are we going to make the decision to let the farmers increase planting by giving some guarantees of higher minimum prices, or must we make a decision as to whether the loan prices we have lived with the last 10 years are unrealistic, or has the cost price squeeze finally caught up with the farmer? These are some of the questions that USDA must answer.

In review, there are a number of areas that I see as a great opportunity for the agricultural economics profession. New legislation must be written for the 1974 crops. There is a great opportunity for some major research with respect to the needs of the U. S. farm community programs.

Sectional Meeting A

AGRIBUSINESS RESEARCH

Subsection A.1-Contributed Papers

Chairman: WALTER M. MYERS, Connell Rice & Sugar Company, Inc.

Papers: Donald B. Agnew, MED, ERS, USDA, "Observations on Agribusiness in Economic Development from a Recent Study of the Livestock-Meats Industry in Panama"

Rex Rehnberg, University of Nebraska, Mission in Colombia, "Milk Production Response of Dairy Cows to Concentrate in Colombia"

O. J. Scoville, Kansas State University, "Farm and Agribusiness Relationships in Economic Development"

Ismail Shariff, University of Wisconsin-Green Bay, "Green Revolution and Food Grain Marketing in India"

P. C. van den Noort, College of Agriculture, Wageningen-Holland, "The Consequences of the Differentiation Process in Food Production on the Supply Function of the Farming Industry"

Subsection A.2-Contributed Papers

Chairman: RICHARD T. CROWDER, Wilson and Company

Papers: Richard S. Fenwick and Gary Devino, Kansas State University, "Optimum Cooperative Capital Acquisition Strategy"

Herbert R. Hinman and Milton Ericksen, FPED, ERS, USDA, "Using Simulation to Calculate Expected Returns from Corn and Soybeans"

Robert L. Oehrman, Oklahoma State University, "Objectives, Motives, Business Style, and Personal History—How They Relate to Managerial Success"

Glenn Helmers, Gary Lentz, and James Kendrick, University of Nebraska, "Specialization and Flexibility Considerations in a Polyperiod Firm Investment Model"

Ken D. Duft and M. J. Carter, Washington State University, "A Proposal for a Pooled Reformulation of the Capital Structure of Banks for Cooperatives"

Subsection A.3-Contributed Papers

Chairman: WILLARD SPARKS, Cook Industries

Papers: Bill R. Miller and Gene Masters, University of Georgia, "Construction and Operation of a Short-Run Price Prediction Model for Egg Prices"

Sujit Roy and Phillip N. Johnson, Texas Tech University, "Econometric Forecasting Models for Quarterly Shell Egg Prices"

Ralph D. Johnson, University of Nebraska, "Physical and Pricing Efficiency Gains from Selling Fed Cattle by Teletype"

Lowell D. Hill and Leroy Davis, University of Illinois, "Spatial Price Differentials for Corn Among Illinois Country Elevators"

Thomas E. Snider, Federal Reserve Bank of Richmond, "Branch Banking and Loan Portfolio Changes—The Virginia Experience"

Subsection A.4-Contributed Papers

Chairman: HARVEY H. S. KUANG, Hunt-Wesson Foods

Papers: Richard J. Foote, John A. Craven, and Robert R. Williams, Jr., Texas Tech University, "Pork Bellies: Quarterly 3-Equation Models Designed to Predict Cash Prices"

J. William Uhrig and James J. Fritz, Purdue University, "An Analysis of Alternative Hedging Programs for a Frozen Pork Belly Merchandiser"

Gerald Engleman, Industry Analysis Staff, Packers and Stockyards Administration, USDA, and Arnold Aspelin, Office of Categorical Programs, Environmental Protection Agency, "National Oligopoly and Local Oligopsony in the Meat Packing Industry"

D. Grant Devine, Canada Department of Agriculture, and Murray H. Hawkins, University of Alberta, "The Implications of Improved Information on Market Performance"

Thomas F. Funk and James C. Snyder, University of Guelph, "Determinants of Market Share for Branded Feeds"

Subsection A.5-Contributed Papers

Chairman: WILLIAM CROMARTY, Connell Rice & Sugar Company, Inc.

Papers: W. M. Holroyd, Farmer Cooperative Service, USDA; B. V. Leasley and J. L. Cain, University of Maryland, "Plant Location Models for a Honey Packer: Sensitivity of Findings to Some Alternative Specifications"

D. W. Parvin, Jr., University of Georgia, "Short-Run Demand for Commercial Catfish"

Leroy Quance, NRED, ERS, USDA, "An Adjustment Model Approach to Projecting Crop Yields"

Francis E. Walker and Robert Jacobson, Ohio State University, "Efficiency Considerations in Butterfat Differential and Component Pricing of Milk"

James D. Sullivan, ERS, USDA, "Estimating Monthly Hog Prices by Market Weight Group: An Application of a Non-Linear Distributed Lag Model"

Subsection A.6-Contributed Papers

Chairman: W. W. MCPHERSON, University of Florida

Papers: Glenn R. Smith, Cooperative State Research Service, USDA, "Has Social Science Research at the Experiment Stations Increased in Line with Social Needs and Congressional Intent?"

Thomas L. Sporleder, Texas A&M University, and Robert R. Wilson, U. S. Department of Commerce, "Consumer Behavior Theory and Credit Card Purchasing"

Dennis R. Henderson, Ohio State University, "Collective Market Action: Its Potential Impact on Farm Structure"

Desmond O'Rourke, Washington State University, "Stylization in Futures Markets"

Thomas L. Sporleder, Texas A&M University, "A Classification Scheme for Market Development"

Sectional Meeting B

APPLIED WELFARE ECONOMICS

CHAIRMAN: DAVID W. SECKLER, COLORADO STATE UNIVERSITY

Agricultural Technology and the Distribution of Welfare Gains*

JURG BIERI, ALAIN DE JANVRY, AND ANDREW SCHMITZ

LITTLE is known about how technology is generated in agriculture and how technological improvements affect different sectors of society both within and outside of agriculture. This becomes apparent after one reads two excellent survey papers by Nadiri [15] and Kennedy and Thirlwall [13] on technological change. It appears that relatively little theoretical and empirical work has been done on the welfare or income distributional effects of technological change. This is unfortunate, for a considerable amount of research funds are spent each year by both private and public institutions to develop new technologies for agriculture.

The purpose of this paper is to discuss the welfare implications of different types of technological advances in agriculture. The welfare gains and losses are "technologically specific." Also, the distribution of welfare gains from technological change depends critically on the industrial structure of the farm firms and the input suppliers to these firms.

Inventions versus Innovations

To understand the welfare effects of technological change, a sharp distinction has to be made between inventions and innovations. The former are means to attaining given ends. Thus, they encompass both the creation of things previously nonexistent and the identification of things which have existed all the time, using either new or existing knowledge. Some inventions are autonomous, while others are induced by environmental circumstances and are subject to the forces of supply and demand. On the other hand, innovation is the commercial application of inventions for the first time. Schumpeter distinguished five

main types of innovation: new products, new processes, new markets and marketing methods, changes in the law, and changes in the methods of business organization. Failure to innovate in contrast to failure to invent has largely contributed to the so-called "technological gap" among nations.

Schumpeter, Galbraith, and others contend that large firm size and a monopolistic industrial structure are essential conditions for innovation. This opinion, of course, is in sharp contrast to the views of the classical economists who contended that monopolies served only to support the negligence, profusion, and malversation of a company's employees. For nonagricultural industries, the evidence of the relation between innovation and market structure is sketchy and conflicting. However, for the farm sector, innovation has and continues to occur in spite of the fact that it is still far from being a monopolistic industrial structure. There are a number of reasons why farmers adopt new methods of production. The major one is to reap Schumpeterian profits (which, in a dynamic framework, vindicates the Schumpeter-Galbraith argument since early innovators can obtain temporary monopolistic positions) which are made possible by the availability of superior inventions.¹ Other reasons include changes in the marginal utility of leisure relative to income or work and the prestige derived from owning larger and larger equipment. Regardless of why farmers innovate, the adoption of new techniques of production is conditional on their availability.

The origin, intensity, nature, and destination of the demand for agricultural inventions are determined by the distribution of the expected welfare gains derived from them. According to the nature of technology, welfare gains will accrue to

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¹ Schumpeterian profits can exist in the farm sector because of the nonexistence of Marshall's "representative firm."

the dominant firms and social groups within the consuming, producing, and input supplying sectors. While the agribusiness sector will supply inventions such as new machinery and chemical products because it can capture at least normal returns from these lines of research, the demand for biological inventions, agronomical practices, and fertilizer application techniques will tend to be met by public research institutions. While all three sectors—consuming, producing, and agribusiness—influence the rate at which new inventions are forthcoming, the demand from the agribusiness sector, where the oligopolistic power appears to be the greatest, tends to dominate.² This is somewhat contrary to the theory of induced inventions as applied to agricultural development by Hayami and Ruttan [9] whereby farmers are largely responsible for inducing the search for technical alternatives in both private and public research institutions. By contrast, in our model farmers themselves generally do not design and send in orders for tractors and seeds not yet in existence. They are not only price-takers but, on the whole, also technology-takers!³ This observation is consistent with our contention that the rate of increase in farm size in the future will be determined, to a large extent, by the rate at which the machine companies manufacture larger and larger equipment. It is also consistent with the saying that present-day farmers are, to a large extent, working for (1) banks, (2) chemical and machinery manufacturers, and (3) consumers. Unless one keeps in mind the process by which technology is generated in agriculture, it is difficult to see whether or not there

are deficiencies in available theories which are sometimes used to explain the welfare consequences of technological change.

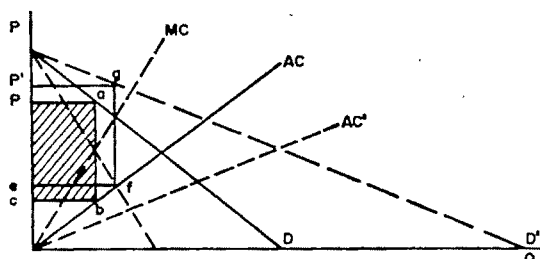
Economic Surplus in Partial Equilibrium Models

A common framework for analyzing the welfare effects of technological change in agriculture has been the partial equilibrium approach based on the concept of economic surplus.⁴ Some examples are the papers by Griliches [8], Peterson [17], and Schmitz and Seckler [20] which deal with estimating the rates of returns from investments in hybrid corn, poultry research, and developing the mechanical tomato harvester, respectively. As an illustration, consider Figure 1 where, prior to any type of technological change, the equilibrium price is P_a . After the technological change, the new price is P_c . The gain in consumers' welfare is given by the area $P_a b d P_c$, while the producers lose by an amount $P_a b 0$ minus $P_c d 0$. Therefore, the net effect on both social groups is $P_a b d P_c$ plus $P_c d 0$ minus $P_a b 0$, which is equal to $O b d$.

Apart from the problem associated with partial equilibrium models in that they are "too partial" for many purposes (i.e., many of the major forces at work are excluded), there is a value judgment needed as to whether or not compensation should actually be paid when a policy is implemented which makes someone worse off while the net social gain is positive. For example, should farm workers be compensated for their loss in employment as a result of the invention and use of the mechanical tomato harvester? It is important for researchers to note that, if compensation is to be paid to those who are made worse off (which, to repeat, is clearly a value judgment) due to some new technology as in Figure 1, all may be better off due to the technological change. However, the consumers are no longer better off by an amount $P_a d c P_c$ since part of this surplus is needed to compensate the producers' loss. After compensation, the gain in consumer welfare is reduced to $O b d$ which is the net social gain.

In a great many policy instances, however, compensation is not paid; hence, the welfare effects from technological change depend critically on the "welfare weights" attached to each sector. In Figure 1, if compensation is not paid, the "net gain" from the technological change is

² The agribusiness firms can gain on two accounts. In the following diagram, with no research by public institutions, the maximum monopoly profits would be $P_a b c$. However, the demand would shift to D' due to research by public institutions, thus allowing for an increase of profits of $P' g f e$ minus $P_a b c$. In addition, the supply schedule can also shift downward (e.g., AC') due to economies of scale thus increasing profits even more.



³ The same type of argument has been made by Galbraith concerning the choices available to consumers.

⁴ This body of literature has recently been surveyed by J. M. Currie, J. Murphy, and A. Schmitz [6].

$P_a b d P_c$ plus $P_c d 0$ minus $P_a b 0$ only if equal welfare weights are attached to producers' and consumers' surplus. This is clearly a value judgment, just as it is to recommend the payment of compensation. Also, if compensation is not paid and equal weights are assigned, it is important to note that, while the net effect is that previously mentioned, the producers still lose, because of technological change, an amount equal to $P_a b 0$ minus $P_c d 0$. Further, if the relative welfare weights of losers *versus* gainers is smaller than the ratio of welfare gains or losses, no amount of compensation will be compatible with a net social gain.

It is interesting that very little empirical work has been done on the welfare gains from technological change where unequal welfare weights are attached to different groups in society. For example, in the Schmitz-Seckler paper [20] equal welfare weights were attached to the income loss of farm workers as to the gain in producer rents. Since attaching unequal welfare weights to different social groups requires no more of a value judgment than attaching equal welfare weights, further research should explore the implications of, say, attaching high welfare weights to those who lose from technological change (when they already are at the lower end of the distribution of income) if compensation is not paid and low weights to those who gain. The weights could logically be patterned along the relationship between the marginal utility of income and the income level. If this were done, many of the rates of return from public investments in technology in agriculture likely would be negative.

Even if (as a result of technological change)

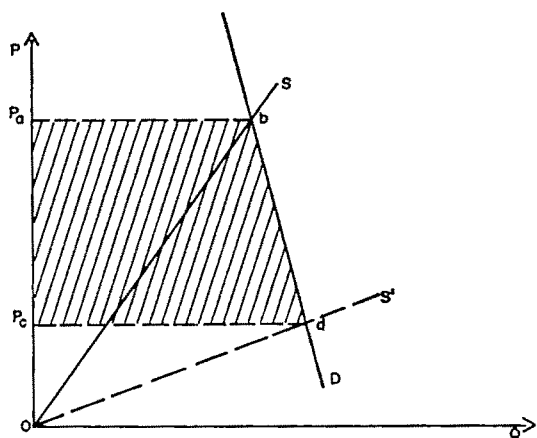


Figure 1

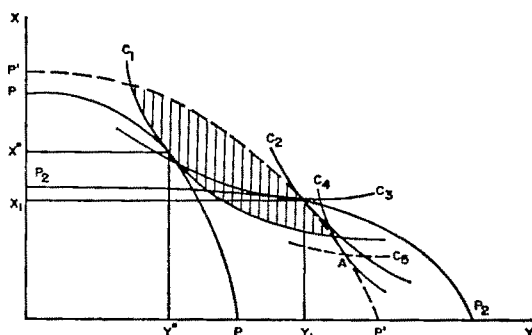


Figure 2

those who lose are compensated, it is worth noting that, if the losers are worse off than the gainers before compensation and are only compensated to the degree that they are no better or no worse off than before the technological change, those who gain are better off, both absolutely and relatively. Thus, unless sufficient compensation is made to the losers, the distribution of income can become, through time, more skewed, and compensation schemes can become regressive in nature.

A General Equilibrium Model

The purpose of this section is to demonstrate that while partial models lead to conceptual difficulties, general equilibrium models based on the "new welfare" economics lead to the conclusion that one cannot say whether technological change, regardless of the sector in which it occurs, is beneficial or detrimental to society. All can be made better off only if appropriate redistribution policies are implemented.

Consider a particular type of technological change which results in the possibility of increasing production of all the goods produced. In Figure 2 the new production possibility curve is $P'P'$, while that prior to technological change is PP . Suppose that before the change the equilibrium bundle is $X^0 Y^0$ and C_1 is the Scitovsky indifference curve. Now consider bundle $X_1 Y_1$ which corresponds to $P'P'$ and is distributed so that C_2 is the Scitovsky indifference curve. It becomes apparent that, if no distortion exists with reference to the expanded production possibility curve, the Scitovsky [21] reversal paradox cannot arise (i.e., the losers cannot bribe the gainers not to make the move). However, suppose $X_1 Y_1$ is redistributed so that the Scitovsky indifference curve is C_3 . Here, a distortion is introduced; and it is clear that the reversal paradox arises when comparing bundles $X^0 Y^0$ and $X_1 Y_1$. In the closed models with no technological change, each of the

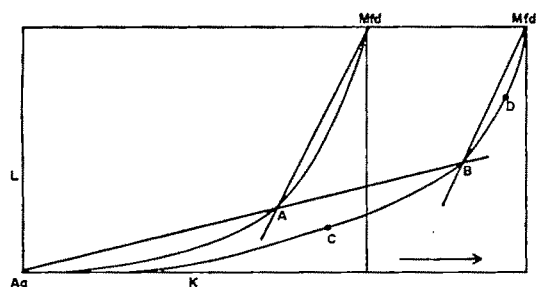


Figure 3

situations compared must contain an economic distortion before the reversal paradox can arise. In Figure 2 only one of the situations has to contain a distortion before the paradox arises; however, it must be the situation pertaining to the expanded production possibility curve. The reader can verify that, if the distortion is with reference to PP and no distortion exists for $P'P'$, the reversal problem does not arise.

In comparing situations where one of the bundles is contained in a set with technological change present, a problem can exist even if there is no possibility of the reversal problem arising. The problem is in determining whether or not the compensation test itself can be met. In Figure 2 suppose there is no distortion along $P'P'$ and the bundle of goods is represented by A , making C_4 the relevant Scitovsky indifference curve. Here one cannot say that the bundle represented by A is better than the X^0Y^0 bundle even though technological change has occurred. In fact, if bundle A were distributed so that C_5 were relevant, growth would be immiserizing. However, it is clear that, if the bundle after technological change can be represented by a point in the crosshatched area, society benefits from such a change.

There is an additional point worth noting. If technological change resulted in P_2P_2 instead of $P'P'$, it is clear that the reversal problem could arise even though no distortions exist in either of the situations being compared since in this case C_3 is tangent to P_2P_2 .

The distribution of factor income due to a technological change depends on the type of change occurring. Suppose in Figure 3 that agriculture is the capital-intensive industry and that at some point in time production occurs at point A . If, for example, a neutral technological change occurs in agriculture with respect to there being an increase in the capital stock for agriculture, the output of manufacturing will absolutely decrease if product prices do not change. Also, if

product prices do not change, the factor proportions do not change in moving from A to B ; hence, the real wages to labor and capital remain unchanged.

However, suppose that, because of product price changes, the capital/labor ratios change as technological change occurs in agriculture. Whether or not the real wage to capital or labor goes up depends on how the ratio changes. If production equilibrium were at D , the real wage to capital would increase as a result of technological change. However, if equilibrium is restored at C , the real wage to capital would decrease as a result of technological change. Thus, the real wage of the factors employed in agriculture need not be affected. However, in all likelihood, the relative product prices will change such that the real wage to either capital or labor will go up when a technological change occurs. In the above model, it is clear that the real wage to both capital and labor cannot increase when technological change occurs.

It is generally agreed that labor is much more agriculturally specific than is capital. Thus, if labor is locked into agriculture, the real wage rate will go up for labor due to a technological advance if agriculture is a capital-intensive industry relative to other industries. However, if agriculture is labor intensive, the real wage to labor in agriculture will decrease as technological change occurs.⁵

The Nature of Agricultural Technology

The following section contains a discussion of yet another way of viewing technological change. Following the Hicksian classification of technological progress, technology embodied in capital goods can be characterized as labor-saving, neutral, or land saving, according to the sign of the bias $B \gtrless 0$, where B is the difference in the rates of change in the marginal productivities of land and labor resulting from the changes in the stock of capital. Capital goods, hence, can be classified also according to their inherent biases. For agriculture, this has led several writers like Heady [10], Sen [22], Hayami and Ruttan [9], Kaneda [12], and Cline [4] to establish a broad contrast between mechanical processes that are essentially labor saving and biochemical processes that are primarily land saving.

Following Heady [10, p. 297], a mechanical innovation essentially "substitutes capital for la-

⁵ In the framework presented in Figure 3, it is impossible to demonstrate a nonneutral technological change.

bor but does not change the physiological outcome of the plants or animals to which it may apply." Hence, "the first effect of mechanization is one alone of reducing total costs." By contrast, "the immediate effect of biological innovation (as classified here) is one of increasing both total output and total costs (per acre or per farm)." According to Sen [22 p. 82], "our experience seems to suggest that while investment in fertilizers, or in irrigation, or in pest control, increases yield per acre considerably (without replacing labor), investment in machines like tractors, threshing machines, etc., is useful mainly in replacing labor (without raising yield per acre)." Similarly, Hayami and Ruttan [9, p. 45] (who include among the biochemical innovations new seeds and breeds; fertilizers, insecticides and pesticides; and irrigation) state that "historically, the dominant factor for saving labor has been the progress of mechanization; and the dominant factor for saving land has been the biological innovations." In a detailed investigation of the relationship between mechanization and output, Cline [4, p. 24] concludes that "the evidence of a positive influence of mechanization on yields (net of double-cropping) is weak" and that double-cropping is unlikely to be practiced in spite of the timing advantages resulting from mechanization in most of Latin America and Africa since it requires irrigation. As a result, Cline [4, p. 22] observes that "tractor mechanization is much more likely to be purely labor substituting than land saving." Bose and Clark [3] find that the only output effect of tractors in West Pakistan is through the land previously used for fodder that is released for production. In Argentina, Pineiro [18, p. 203] observes that the intense substitution of tractors for labor between 1947 and 1964, which occurred with nearly constant land and land-saving resources, did not have any significant impact on aggregate output.

Following this somewhat simplistic approach, an aggregate production function for the agricultural sector can be conceptualized where (1) there are four inputs—labor, land, labor-saving capital (machinery), and land-saving capital (biochemicals) denoted respectively by L , T , K_L , and K_T ; (2) L and K_L are highly substitutable and, similarly, so are T and K_T ; and (3) substitution possibilities between K_T or T and L or K_L are low. Consequently, with an inelastic aggregate land supply and *ceteris paribus* for the land-saving capital goods, K_L can be only mildly output-increasing since the output effect is blocked by the fixed land and land-saving inputs.

Under these circumstances, mechanization is essentially labor displacing. Also, with an inelastic land supply and *ceteris paribus* for the labor-saving capital goods, K_T is highly output-increasing as long as the elasticity of supply of labor is high.

The aggregate production function for agriculture can be written then as a two-stage function:⁶

$$Y = T F [f_T(T^*, K_T^*), f_L(L^*, K_L^*)]$$

where T is an index of neutral technological change and where the $*$ denotes inputs measured in effective units that are related to the nominal input units through a factor-augmenting coefficient of technological change. The subfunction f_T is an index of "land" inputs, while f_L is an index of "power" inputs. Input substitution possibilities, characterized by the Allen partial elasticity of substitution [1, p. 504], are high within each subfunction (σ_{LK_L} , $\sigma_{TK_T} > 1$) but quite low among subfunctions (σ_{LT} , σ_{LK_T} , σ_{KL_T} , $\sigma_{K_L K_T} < 1$).

To complete construction of a one-sector neoclassical model of the agricultural sector, it suffices to add a final demand equation with price elasticity η , a set of factor supply functions with own-price elasticities ϵ , and a set of first-order conditions for profit maximization.

Using this model, the intersectorial distribution of welfare gains from specific types of technological changes can be determined. To give punch to the argument, consider the stereotyped but realistic case where (1) land is in completely inelastic aggregate supply, (2) the inter-subfunctions elasticity of substitution $\sigma_{K_T L}$ is nearly zero, and (3) shifts in product supply result from technological changes or from shifts in factor supply either of machinery or of biochemicals but always holding constant the level of use of the other capital good.

Under these assumptions, mechanization is purely cost reducing, and the resulting net social gains accrue wholly to landowners in both closed and open economies since welfare gains are capitalized in land values. Hence, where farm organizations are powerful enough, they would voice landowners' interests into pressing the public sector and the agribusiness firms to generate mechanical innovations. In this case the technological treadmill, as shown earlier by de Janvry [7] and Herdt and Cochrane [11], materializes through rising land values. Adopters of mechani-

⁶ See de Janvry [7] and Sato [19] for a detailed discussion of this specification.

cal innovations bid up the price of land, internalizing the welfare gains from mechanization in land values, and thus raising the opportunity cost of holding land for nonadopters who are, in turn, forced to mechanize also.

While under perfect competition the net social gains from biochemicals accrue to consumers in a closed economy and generally imply an income transfer from producers to consumers extracted by the market mechanism, they benefit landowners in an open or in a farm-price supported economy. In the open-market case, welfare gains to the whole economy arise only from increased exportable surpluses and the import multiplier. Hence, while in a closed free-market economy there is a definite conflict of sectorial interests between the use of mechanical and biochemical techniques, this conflict does not arise in an open economy where, to the contrary, both producing and consuming (import multiplier) sectors benefit from following a technological path in which biochemicals enter. If supply control or price support programs exist in the closed economy, the net social gains accrue wholly to producers; and these gains are larger under a price-support program than under a supply-control policy where both achieve the same farm price level. In the closed free-market economy, the dynamic diffusion mechanism of new biochemical techniques occurs through the Cochrane [5] and Owen [16] "Mill-Marshallian" treadmill of falling product prices. By contrast, it occurs via the land-market treadmill in the open and in the farm price-supported economies. In the United States, Back [2, p. 338] observes that "the net result of technological advance concurrently with public farm programs such as we have had the past 30 years is mainly a continuous rise in farm real estate values," indicating that this last dynamic diffusion mechanism may have been the effective one.

Within the agricultural sector, the personal distribution of welfare gains from technological change is determined by both (1) the functional distribution of income and the pattern of factor ownership and (2) the structure of the agricultural sector and the nature of the prevailing factor market imperfections that condition the inter-firm differences in the adoption process of new technologies.

Considering the functional distribution of income, of particular importance is to trace out the impact of alternative technological paths on the employment of, return to, and share of labor in agriculture. Since it is known that labor income

is more progressively distributed over individuals than are returns from land and capital, plans that are detrimental to the income and employment position of labor will tend to indicate (at least until intersectorial reallocation of resources is sufficiently performed) increasing regressiveness in the distribution of agricultural personal incomes. Adding to the above three assumptions the one of linear homogeneity, it can be shown in this model the distributional implications of neutral or factor-augmenting technological changes and of shifts in product demand or factor supplies.

Consider the case of a factor-augmenting technological change in machinery. In a closed economy ($\eta < 1 < \sigma_{KLL}$), the employment of, return to, and share of labor will decrease, while the share of capital will increase. Hence (particularly if employment opportunities outside of the agricultural sector are low), mechanical innovations tend to have a regressive impact on the distribution of agricultural incomes, and there exists a trade-off between objectives of progressiveness in the distribution of income and of increasing agricultural output. In an open economy ($1 < \sigma_{KLL} < \eta$) by contrast, while the distributional bias is still in favor of capital, the employment of and return to labor will increase.

Factor-augmenting technological change in biochemicals increases the employment of and return to labor in both closed ($\sigma_{KTL} < \eta < 1$) and open ($\sigma_{KTL} < 1 < \eta$) economies and biases the functional distribution of income in favor of labor.

Changes in the functional distribution of income, due to shifts in the supply of capital goods, have qualitative implications similar to the ones of factor-augmenting technological changes.

Market and Institutional Distortions

What has not been emphasized in the previous sections is that market imperfections and the nature of institutional services affect the distribution of welfare gains from agricultural technology both within the farm sector and among the farm and related sectors of the economy.

The diffusion pattern of new technologies determines the distribution of Schumpeterian profits or losses within the farm sector. Numerous *ex post* empirical studies of the diffusion of new techniques have consistently evidenced that early adopters are principally found among the large and comparatively wealthy capitalist entre-

preneurs.⁷ A fact that has not been analyzed so clearly is the type of market and institutional imperfections that actually do permit large farmers to reap Schumpeterian profits and the reasons for the existence and perpetuation of these distortions.

Large farmers tend to have easier access to capital markets, to information, and to education, particularly in less-developed countries where these three factors typically are in limited supplies at the going prices, and, hence, are not allocated among firms through market forces but through the social system. The advantageous position of these farmers permits them to reap Schumpeterian profits by using new technologies and then buying more land, displacing less-favored farmers. This interfirm bias is particularly dominant in the case of machinery *versus* biochemicals where indivisibilities and the reduction of labor management needs generate economies of scale, where the magnitude of the investment requires easy access to the credit market, and where the length of the payroll period implies stronger ability to withstand risk. Further, coercion in diffusion via the landmarket treadmill tends to be particularly regressive on the tenant farmers who see the inflated land value transferred rapidly to their cash costs (while the cash income position of owner-operator is not affected) since land prices tend to adjust to their new equilibrium levels faster than product prices. With imperfect factor markets, institutions which favor certain social classes and limited factor mobility, the diffusion process can easily transform the essentially scale-neutral technologies of, for example, the green revolution into immiserizing forces for a large share of the total farm labor force. For the green revolution to bear its intended social welfare benefits, improvements of the performance of the factor markets and of the institutions directly affecting the farm sector need be obtained at the same time that new technological opportunities are being made available. From past experience, the relatively easy generation of technological advances has all too often been performed at the neglect of the arduous task of managing structural changes. Unless this is done, the small farmers and farm workers tend to be the prime losers in the structural readjustments of agriculture that follow the spread of technological advance.

A major deficiency in the theoretical analysis of the previous sections is that the number of

sectors included are too few, and intersectorial market imperfections are eliminated. One has to include in the analysis of the welfare effects of technological change, consumers, the farm sector, and the suppliers of inputs; and the industrial structures of all these sectors have to be taken into account. Reconsidering the green revolution, innovations came about not only through the development of new seeds, but these were accompanied by irrigation facilities, fertilizer, chemicals and, in many cases, new machinery. Thus, the producers of the new seed varieties set up the preconditions which were necessary for the input suppliers to agriculture to reap profits. By concentrating the analysis, as is commonly done, on only landowners, farm labor, and final consumers, one misses a major reason why these technological changes occurred in the first place. Sufficient profits had to be made by the suppliers of inputs as well as by some of the agricultural producers for the new technological change to come into existence. First, for the invention to come about, either a monopoly and/or an agency acting as a public body had to exist. Second, one could hardly doubt that the suppliers of inputs gained from the technological change. Third, it is sometimes doubtful whether or not the consumer, for whom the green revolution was largely intended, benefited.

Agribusiness firms invent, both using their own research teams and the facilities of the public sector, only if sufficient profit can be made from the sale of these inventions. Also, farmers innovate only if sufficient profits can be obtained. For agriculture, inventors and innovators belong to different industrial structures. As pointed out, inventors will tend to belong to a monopolistic or oligopolistic structure. Thus they control both the type and the rate of invention. Because of the industrial structure of the suppliers of inputs, the magnitude of any welfare gains from technological change which could potentially accrue to various groups in the agricultural-producing and consuming sectors depends greatly on the extent of the monopoly power in the input supplying industries.

Summary and Conclusions

In this paper an attempt has been made to explore the welfare effects of technological change in agriculture. This is an extremely important topic but one which, as Marx has clearly shown, does not readily lend itself to rigorous economic analysis. Using different models, the authors have derived various conclusions about who gains

⁷ See, for example, the study by Mansfield [14].

and who loses from various types of technological change. However, the validity of these conclusions depends critically on the realism of assumptions. Somewhat unreal assumptions can lead to "neat" conclusions, but how useful these are is another matter. The authors' feeling is that the common approaches used to answer the question of how income distribution is affected by technology are unsatisfactory in that they do not consider the industrial structure of the three major sectors involved: (1) the input suppliers to agriculture, (2) the agricultural-producing sector itself, and (3) the food distributing and consuming sectors. Once the topic of the distribution of welfare gains is cast in the theory of industrial organization and social conflict, the effects of each type of technological change will depend on how much of the economic surplus can be extracted by each group. The more powerful the suppliers of inputs and the retail food chains, the smaller are the gains from technological change which accrue to the final consumers and the agricultural farm firms.

The authors have contended, opposite to the belief of many, that the generation of most farm technology is outside of the control of the individual farm firm. However, more empirical work is needed to support this proposition. Also, it is difficult to generalize about welfare gains from technological change. It is certain that good empirical studies would show that the welfare consequences of developing a mechanical tomato harvester are different from those of developing a grape harvester. This is because, in view of the main theme, the bargaining power of each of the groups involved differs from one case to the other. If this is true, one should be careful in making the distinction that is commonly made between mechanical and biological innovations, for it could be that the variation in the welfare effects from different types of mechanical innovations is as great as between those of a biological and a mechanical nature. Also, as has been pointed out, the distinction is dangerous to make for a technological change in agriculture usually encompasses both.

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Welfare Analysis of Poverty Programs*

D. LEE BAWDEN

TRADITIONAL welfare theory has been identified with evaluating the welfare implications of market activities, such as trade, market structure, price instability, technological innovations, etc.¹ This analysis has been within the framework of producer and consumer surplus. Classical theory considered changes to be Pareto optimal only if both parties were made better off. Neoclassical theory embodied the compensation principle, which allowed change to be designated as Pareto optimal even though one party was made worse off, if the second party could compensate the first for his losses and still remain better off. In other words, the total benefit exceeded the total cost, but compensation actually had to take place for the change to be Pareto optimal.²

In poverty programs, one does not usually think of situations in which total direct dollar benefits of a change exceed total dollar costs; in fact, it is just the reverse. Dollar costs usually exceed direct dollar benefits because of administrative costs. In such cases the transfer can be deemed desirable by traditional welfare theory only by maximizing an assumed social welfare function which makes interpersonal comparisons. (The simplest such case is the assumption of identical utility functions for everyone, a declining marginal utility of money and no administrative costs. Social welfare is then maximized when everyone's income is made identical through lump sum taxes and transfers.)

The problem is that there can be as many different social welfare functions as there are people; and the theory offers no criteria to make choices among them. Unfortunately, this is where neoclassical welfare theory ends. Consequently,

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¹ See [6] for a recent review of classical and neoclassical welfare theory.

² In practice, of course, compensation usually does not take place, yet policy is frequently recommended and implemented on the basis of a benefit/cost ratio greater than one.

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its usefulness in analyzing welfare programs has been extremely limited.

But the picture is not now all that dismal. Recently two articles have appeared which offer an alternative to this orthodox approach [9, 12]. They argue that one does not need to assume a utility function with interpersonal comparisons to show that transfer programs can be Pareto optimal; it may be sufficient merely to assume interdependent utility functions. In other words, if givers derive some utility from knowing that receivers are better off (or from observing the consequences of their being better off), then a transfer may be justified on the basis of such externalities alone.

This is not a *normative* theory of transfers as claimed by Olsen [12]. Rather, it is a *positive* theory based on the concept of donor sovereignty. Under this principle, transfers are made only if the giver *wants* to make them and the recipient *wants* to receive them. There is no compensation of "losers" by "gainers" because there are no losers.

This approach to analyzing transfer programs is relatively new, and the underlying theory has not been fully developed. The purpose of this paper is to (1) evaluate the adequacy of this body of theory and (2) assess its potential for empirically analyzing poverty programs.³

Evaluating the Theory

These new theoretical developments are aimed at answering the following questions:

1. How much should be transferred?
2. What form should the transfer take (e.g., cash, food, medical services, housing, etc.)?
3. To whom should the transfers be made, and in what amounts?
4. From whom should the transfers be made, and in what amounts?
5. How are answers to the above questions influenced by
 - a. the effects of the program on the recipients?
 - b. the efficiency of administering the program?

³ Many public programs can be regarded as "poverty" programs in that there is some transfer from high- to low-income groups, e.g., public education, free inoculation, etc. However, my focus will be on programs for which eligibility is determined by an income test.

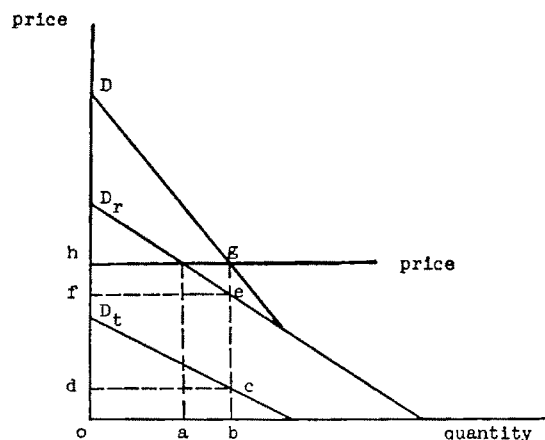


Figure 1

Each of these questions will be addressed in terms of whether the present theory provides *qualitative* answers to them. Then, the potential for utilizing these theoretical principles to provide *quantitative* answers to the same questions will be discussed.

The amount transferred

The assumption of interdependent utility functions allows a theoretical specification of how much should be transferred. For specificity, assume the case of a subsidized medical care program for low-income families. (The example can also be thought of as a cash transfer program in which the "commodity" transferred is a bundle of all consumption goods.) A two-person example is illustrated in Figure 1. D_r is the demand for medical care by a low-income family (the Receiver). D_t is the amount of medical care that a high-income family (the Giver) is willing to transfer to the Receiver (R). This is a direct consequence of the Giver's (G) interdependent utility function. The vertical sum of these two demand curves represents the total demand (D) of medical care by R . At the price shown, R would consume oa of medical services in the absence of a transfer and the quantity ob after the transfer. The amount of the transfer to R is represented by the rectangle $obcd (= fegh)$.

At the price shown, this amount of transfer is Pareto optimal; both R and G are better off and neither's position can be improved except at the other's expense. Consequently, the theory does tell us how much is to be transferred between two families within the context of a *specific* welfare program. The situation becomes much more complex, however, when there is more than one

Giver and more than one form in which the transfer can be made [16]. These difficulties will be discussed below.

The form of the transfer

Under neoclassical welfare theory it was common to assert that the most efficient transfer was in cash, for it maximized the utility of the recipient by allowing him an unconstrained choice in consumption. This conclusion, while valid, is not necessarily relevant when welfare programs are analyzed in the context of interdependent utility functions. If G derives utility from making the transfer simply because R is better off, then a cash transfer will at least be as good as, and probably better than, any in-kind transfer program. However, G 's utility is often derived from observing the *consequences* of R being better off [13]. An example of this is not having to view unsightly housing (a negative externality). In fact, if the current situation can be interpreted as revealed preference, then Givers prefer in-kind to cash poverty programs by more than a two to one margin.⁴

The application of welfare theory to in-kind poverty programs is more complex than the application to cash programs because the valuation of in-kind benefits by Receivers may be considerably less than the amount transferred from Givers, even when administrative costs have been deducted. For example, Smolensky and Gomery [14] estimated that taxpayers in 1965 were spending \$65 per unit for federal public housing programs to provide a subsidy which the tenants valued at only \$27 per unit per month.

There are many in-kind poverty programs (e.g., food, housing, medical services, job training, social services, day care, etc.). Von Furstenberg and Mueller [16, p. 635] argue that a lack of consensus among Givers on a specific combination of programs may preclude reaching a Pareto optimal position, even if agreement is reached on the amount of the transfer. In other words, the transfer demand of each Giver for each program cannot be determined and then aggregated to arrive at an optimal package of programs. This occurs when the optimal mix of programs in the transfer demand of Giver A is not independent of the program mix in Giver B 's transfer demand. For example, $G (A)$ may want R to receive 50

⁴In 1970, public assistance totaled \$8.9 billion, while government expenditures for income-conditioned food, housing, medical, and training programs amounted to about \$19 billion.

percent of the transfer in cash, 30 percent in food, and 20 percent in housing. However, if $G(B)$ prefers that R receive only cash, then $G(A)$ may change his preferences by decreasing his demand for a cash transfer and increasing his demand for the two in-kind transfers to offset $G(B)$'s preference so that the total transfer to R more nearly equals the 50/30/20 distribution.

Since, in practice, changes in programs are usually considered separately, given the level of all other programs, this may not be a serious limitation. But to the extent that it is politically easier to expand than to cut back benefits of a particular program, individual program changes could lead to a nonoptimal mix even though each individual change is preferred.

In summary, existing theory provides a fairly adequate framework for determining the optimal mix of cash and the various in-kind poverty programs only if a marginal change is being considered for one program.

To whom and how much?

The amount of goods consumed (or income received) by R appears in the utility function of G , and, hence, influences the transfer demand (D_t) of G . While the optimal amount of the transfers to each R becomes more difficult to determine as the number of Receivers increases, the theory does provide a basis for establishing a Pareto optimal transfer to each R .⁵

This is an area in which a weak specification of interpersonal utilities would add substantially to existing theory. I have in mind two concepts—horizontal equity and vertical equity. Horizontal equity means that two individuals in identical circumstances (as viewed by G) are treated equally by any given poverty program.

This principle is often violated in practice: the Federal Low-Income Public Housing Program is an example. In 1965, only 3 percent of the total eligible population benefited from public housing [14, p. 48]. Horizontal equity is violated since individuals of equal means, living in the same area, are treated differently by the program.

There are also sizable regional differences in public housing participation. For example, the percentage of tenants to the eligible population was 6.1 in the central cities and 0.7 outside the SMSA's. This variation, however, may be consistent with welfare theory. Those inside and out-

side of SMSA's may not be in identical circumstances in the eyes of Givers. One could hypothesize that the utility to Givers is much higher in urban areas where dilapidated housing is more visible.

In general, the principle of horizontal equity is violated whenever (1) the government sets both the price and quantity of a transfer good, (2) the quantity set is less than the quantity demanded at that price, and (3) the goods must be consumed in discrete units such that the total number of units is less than the total number of eligible Receivers. In addition to public housing, these conditions are present in government-sponsored job training, day care, and social service programs.⁶

Vertical equity insures that the relative position of two individuals (or the same individual at two points in time) prior to the transfer is not reversed after the transfer.⁷ This principle is also violated in several programs. In the AFDC program for unemployed parents (AFDC-UP), payments are made to the family if the father works less than 35 hours per week (and his income is sufficiently low). If he then begins to work 36 hours per week, the family loses *all* benefits under the program. Thus, the addition of \$10 in earned income per month might result in a loss of \$100 per month in benefits.⁸

Medicaid exhibits the same inequity in those cases in which medical benefits are conditioned upon eligibility for public assistance. A small increase in earned income can make a family ineligible for welfare payments, resulting in a loss of some \$800 per year in medical benefits.

From whom and how much?

In practice, poverty programs are financed from general tax revenues.⁹ The entire tax struc-

⁵ An interesting issue in horizontal equity is provided by the Food Stamp Program, which does not constrain total quantity but establishes a minimum purchase requirement along with the price. Participation, then, depends on such factors as availability of transportation to the stamp distribution center, distance from the center, the cost of time, and the individual's utility function.

⁶ This is referred to as "the notch problem" in some poverty research literature.

⁷ This is a good illustration of the difference between before-program and after-program vertical equity. If the principle were that a person better off *before* the transfer is not treated more generously than another person worse off, then the AFDC-UP program would satisfy this condition because the person moving from 35 to 36 hours per week is obviously better off before the transfer.

⁸ This need not be the case. One could conceive of two taxation schedules, one to pay for those government pro-

⁹ In practice, receivers are lumped in groups (e.g., by income classes or place of residence, etc.) by givers in making this determination.

ture is beyond the scope of consideration here.¹⁰ However, within the parameters of the tax system, Olsen's theory [12] does yield qualitative statements about how much G is willing to transfer to R .

When more than one G is involved, interdependence in utility functions among Givers presents a problem here, too [16]. The transfer demand of Giver A is dependent on the transfer demand of Giver B , and it is possible to reach Pareto optimality only if each knows the demand of the other. For marginal changes in poverty programs, this may not present much of a problem since presumably Givers know the points on each others' demands as revealed by the status quo. For large changes, the interdependency problem is serious and can be only partially circumvented by polling Givers under alternative assumptions about other Givers' demands.

Effects of the program

The effects of the program obviously influence the utility of G . The primary effect may be to reduce a negative externality or increase a positive one, but programs often have secondary and sometimes unintended effects. A good example of this is Nixon's welfare reform proposal, which would extend public assistance to families headed by an able-bodied working male. A potential secondary effect of the program is that recipients may reduce their work effort. Such a negative consequence could override any positive effects in G 's utility function. In fact, if one wanted to rely on revealed preferences, this appears to be the case. The welfare reform bill died in Congress last year and will probably do the same this year.

Welfare theory tells us that *all* consequences of a given program can influence G 's transfer demand, but to date there is little evidence on either the magnitude or direction of this influence for specific consequences.

Efficiency of administration

Ceteris paribus, the more efficient the administration of a program, the higher will be the Pareto optimal subsidy received by R [12], even though the optimal amount transferred by G will be less if he is on the inelastic portion of D_t . In any

event, increased efficiency leads to a direct increase in utility to both R and G , all else held constant. However, this does not imply that both R and G will be better off if *less funds* are devoted to administration. Administrative expenses may be negatively correlated with time required by R to become certified as eligible for the program and the waiting time involved in receiving the transfer (e.g., free medical services).¹¹ The fairness with which a program is administered (e.g., through more local offices, wider dissemination of information about eligibility requirements, the processing of more frequent income reports by recipients to reflect changing income levels), and the reduction in cheating (e.g., through more frequent audits) may also be relevant variables in G 's transfer demand function.

An overall assessment

This concludes a rather brief review of recent developments in welfare theory that are particularly relevant to the analysis of poverty programs. Some general remarks are in order. The theory at the present stage of development is too simple to deal adequately with the complexities of the real world. It is inadequate in dealing with large numbers of G 's and R 's. It does not reflect the fact that some R 's are also G 's (taxpayers). It does not incorporate the possibility of some R 's being more important in G 's transfer demand because they are more vocal (e.g., those represented by the National Welfare Rights Organization).

The theory also ignores the transfer demands of congressmen and administrators. The bureaucracy does not necessarily play a neutral role.¹² For example, administrators of a program are also givers, and each has a transfer demand. But they have more influence on the program they are directing than any individual taxpayer. If they were drawn randomly from the general population of Givers, their role would still be neutral, but this is not likely to be the case. Administrators are probably attracted to agencies having objectives with which they are sympathetic. Thus, a person with a high transfer demand is more likely to seek employment at HEW than at the Department of Defense.¹³

¹¹ The use of queues to ration merit goods, and the differential effects on users, is explored in [11].

¹² See Albin and Stein [1] and Bryant [5] for discussions of the administrator's role in the context of Public Assistance and the Food Stamp Program, respectively.

¹³ Bryant [4] conducted an interesting analysis of the Food Stamp Program in which he developed a model from

grams in which all citizens "theoretically" participate equally (e.g., national defense) and another to finance those programs which are income-conditioned.

¹⁰ See Hochman and Rodgers [9] for a discussion of alternative tax rates and a comparison with existing transfers, by income class.

Finally, and most important, the theory is based on the concept of donor sovereignty. To accept this principle as *the* criterion for determining the optimal amount transferred is to ignore the existence of a social utility function. Operationally, this means that we accept the notion that the government is, in the realm of transfer program, merely a vehicle of the Givers—an administrative mechanism to satisfy the wants of Givers, transferring only quantities “voluntarily” specified by them. This implies that public projects in which there are some losers (virtually all projects) should not be implemented unless the benefit/cost ratio is greater than or equal to one and the gainers compensate the losers.

I will now turn to the potential for using this theory *quantitatively* to analyze poverty programs.

The Potential for Empirical Analyses

To begin to answer quantitatively the questions of how much, from whom, to whom, and in what form, aggregate estimates of the three demands (Givers', Receivers', and total demand) are needed for each program.

One approach is to apply regression analysis to time series data. For programs currently in existence, we do have observations of the amounts transferred and the amounts consumed over time. The intersections of these with prices, which are also available, could be regarded as points on the Givers' transfer demand and the total demand, respectively. Observations of the Receivers' demand for existing programs do not exist, but since D_r is merely the difference between D and D_t , it can be derived.¹⁴

One limitation of this approach is that it assumes the observations are equilibrium points. This, of course, is a tenuous assumption for any type of demand analysis, but it is probably a more serious limitation here because the public sector “market” is slower to respond to changing preferences than most private markets. Perhaps some of this difficulty can be circumvented, however, by the use of statistical techniques (e.g., distributed lags).

A second problem with time series analysis is that many of the current programs have not been

the administrative agency's point of view to predict prices, quantities, and participation rates. His work suggests that a theory which considers only G and R could be improved by incorporating the utility function of the administrative agency.

¹⁴ See [3, and 4] for some estimates of the total demands for various programs.

in existence long enough to generate a sufficiently lengthy series of data for statistical analysis. However, there are sufficient time series data for Old Age Assistance, Aid to Dependent Children, Aid to the Blind, Aid to the Permanently and Totally Disabled, General Assistance, Public Housing, and the Food Stamp Program. In summary, despite some limitations, one should be able to get approximate estimates of both price and income elasticities of transfer demand for some of the major poverty programs by this method.

A second approach to estimating the aggregate demands for various poverty programs is the use of cross-sectional data—variations among states or, for some programs, variations among counties within states.¹⁵ For all cash programs and for some in-kind programs, states must contribute to the total program cost. Relating differences in revealed preferences among states to prices and income levels of R and G could provide price and income elasticities. Such an analysis should also yield interesting coefficients for certain control variables, such as wealth, race, rural/urban ratios, region, political affiliation, and religion.

A third approach to estimating the transfer demand of Givers is to study private charity [10, 15]. Data from private charitable organizations (e.g., the United Fund) might allow an estimate of the transfer demand for private charity. But, as Goldfarb [7] has shown, this would be an underestimate of the transfer demand for public programs. Givers derive more utility by contributing through public than through private channels, given an identical recipient population. This is because each G can be assured of “matched” giving by others (no free riders) and, hence, more will be transferred to the Receivers.

The above three approaches have relied on revealed preferences toward actual past or current programs to measure aggregate Givers demand and total demand for a specific good. Empirical studies of this type are not useless in evaluating new changes to existing programs, but neither are they satisfactory. Moreover, they provide little if any information on the evaluation of an entirely new poverty program. This suggests a fourth approach, namely, experimentation.

Experimentation is usually only feasible when evaluating situations which represent an increase

¹⁵ See Henderson [8] for a cross-sectional analysis of county data to identify the determinants of per capita public expenditures and local taxes. His equations were derived from a specific collective welfare function aggregated over all public and private expenditures.

in welfare over present conditions. (Individuals will not participate in an experiment which makes them worse off. Of course, forms of bribery which will have a neutral effect on the experimental variables can sometimes be used.) This suggests that experimentation is most useful in evaluating new programs or larger benefits of existing programs.

Experimentation is currently being employed to evaluate an income maintenance program which makes cash grants to the working poor [2, 17]. These experiments are designed to determine the least-cost combination of program parameters (the negative tax rate and maximum guarantee, in light of induced work disincentive), as well as effects of the program on the behavior of the Receivers.

One can think of experiments which would attempt to directly measure transfer demand of the Givers. For example, different deductibility levels or percentages on the positive income tax could be simulated by experimentation (via direct reimbursement) for contributions to private charities. This would measure the transfer demand in relation to changes in price to *G*.

Finally, one can experiment with different administrative practices (e.g., frequency of reporting income, level of audit, degree of documenta-

tion required, etc.) to relate the cost of the program to various consequences which are considered important in *G*'s utility function. OEO is currently considering a proposal for such an experiment.

Concluding Remarks

The concept of interdependent utility functions has been around for some time, but only recently has this concept been regarded as a help rather than a hindrance in the theory of transfers. This has led to a breakthrough in the usefulness of welfare theory for analyzing poverty programs. Granted, the current level of development is far from adequate, but there will undoubtedly be further refinements and extensions.

More seriously, the underlying concept is one of donor sovereignty, which ignores the existence of a social welfare function. Nevertheless, the new theory is a useful tool within limits and should stimulate empirical research in an area long neglected by economists. The amount of transfers under Pareto optimal conditions should be less than or equal to the amount under a social welfare function. To the extent that some poverty programs fall short of both, empirical research could lead to a more rational transfer system as well as to more efficiently administered programs.

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Discussion: RICHARD A. KING, North Carolina State University

The purpose of this sectional meeting is to explore the applicability of welfare theory to social problems. Bieri, de Janvry, and Schmitz considered the measurement and use of welfare indicators in development programs and Bawden the analysis of poverty programs. My few remarks attempt to bridge the gap between such research endeavors and our teaching of applied welfare concepts.

That such a gap exists will not be defended here, but simply stated as fact. There may be more argument over whether this gap should concern us. At least it is of concern to me. Just this last week we were entertained on the evening news by the suggestion of the Secretary of Agriculture that Senator McGovern, in the event of a November victory, might well select Cesar Chavez as Dr. Butz' replacement. And that recent analysis of the performance of the land-grant colleges entitled *Hard Tomatoes, Hard Times* has set a good many tongues to clacking.

How well do we handle the issue of higher wages for lettuce field workers? Or the effects of the tobacco program on tenant farm families? Or the effects of a \$.25/cwt. increase in the price of class I milk? Is it enough to say that interpersonal comparisons are not possible or to devise some measure of aggregate community welfare? A middle ground is needed that will better help our students to evaluate alternative public and private choices. My suggestion is that we use "participant indexes" to describe the effects of particular policies on the several parties in a system or subsystem. Let me elaborate on this idea very briefly.

By the close of the Seventies it seems quite likely that the formal modeling of economic systems through time will have replaced much of the static equilibrium analysis that presently dominates both our research efforts and our teaching of economics. The measurement of equity effects of alternative public pricing strategies is representative of the type of problem that necessitates a framework within which the participants respond gradually and systematically over time to specified shocks to the system.

For purposes of illustration I will use the New England dairy industry relationships developed by Marvin Kottke at Connecticut [2]. We begin with the competitive case and compare those results with two alternative classified pricing policies. This three-sector model is then expanded to

a multiregion system and the possibility of incorporating subregion participant relationships is discussed. These models are compared with some other well-known simulation studies in another paper [1].

Assume an initial price of \$5.00 per cwt. for both fluid and manufactured milk. The Kottke system reaches competitive equilibrium price of \$4.615 per cwt. in year 10 and equilibrium milk production and consumption of 72.772 million cwt. in year 11.

When we introduce a classified pricing system with fluid milk prices established by a market administrator, we have a somewhat more complicated model. Since the fluid price will be established above the competitive price, we may allocate first whatever quantity will be purchased in this market and then allocate the remainder to the manufacturing milk market.

Prices in the base year, representing 1965, are \$5.90 for fluid milk and a blend price of \$5.00. It turns out, quite by chance, that these values for blend and fluid prices are very close to the equilibrium values for the Kottke system. With a constant price over time for fluid milk at \$5.90 per cwt. the quantities sold on each market are stable, and the outlay of consumers for each product type is also stable over time.

If we allow the administratively set fluid price to rise 5 percent per year from the initial price of \$5.90 per cwt., the result is to raise blend price although more slowly than the fluid price, increase the consumption of manufactured milk, and decrease consumption of fluid milk over time. Total revenues in each product market move in the opposite direction from quantities sold and total revenue rises over the 10-year run.

Such changes can be expressed in index terms. These index numbers can be thought of as crude "participant indexes" in that they measure changes in producer revenues, resources used in milk production, quantities of products purchased, and dollar outlays by consumers. Measures of change in the system under the three pricing schemes summarized in Table 1 provide a basis for comparison of the three policies in terms of who wins and who loses and by how much.

Selection of appropriate sector models calls for a combination of econometric analysis, intuition, and comparison of model behavior with that of the system under study. The acid test of a model

Table 1. Participant indexes for three fluid milk pricing alternatives

Measure	Year	Price policy		
		Competitive pricing ^a	Administered pricing ^b	
			\$5.90	\$5.90+5%/yr.
Quantity of milk produced and consumed	0	100	100	100
	5	98	100	101
	10	98	100	103
Fluid milk use	0	104	100	100
	5	104	100	95
	10	103	100	89
Manufactured milk use	0	96	100	100
	5	93	100	107
	10	93	100	116
Dollar value of transactions	0	89	100	100
	5	91	100	110
	10	91	100	119

^a Initial price of \$5.00/cwt. in year 0.

^b Base situation = 100; administered Class I price of \$5.90/cwt., assuming previous period blend price of \$5.00 in year 0.

system is whether or not it "will fly." Given realistic initial values, will the model run over time in a way that produces sensible results? Is the model constructed in such a way that it will respond to policy alternatives that were established in the initial phases of the investigation? Can the results of these alternatives be summarized in terms of "participant indexes" that reflect the impacts on various groups?

That final question leads to an extension of a multiregion model in order to incorporate behavior of subgroups within each region. For example, the milk production sector might be subdivided

into "small," "medium," and "large" producers if it was thought that the responses of the several groups to a given change in price might be different. Perhaps alternative employment opportunities for each group are such that the supply function is drifting to the left for the smaller producers and to the right for the larger, commercial herds. Computationally, introducing these group supply functions is identical to adding new producing regions to the model. Such a formulation would allow measurement of changes in the structure of producing or processing sectors in response to policy choices.

The relationships among recent simulation methods as I see them are something like this. In the Kottke analysis we see how the transportation model and reactive programming can be used to trace market equilibria over time in a multiregion model with full consideration of policy choices. In the Lee-Seaver study of U. S. broiler markets [3] we see that simultaneous equations can also reproduce market behavior over time, but policy relationships may be more difficult to introduce unless the equation system is placed in a larger model. The systems networks developed by Manetsch *et al.* [4] provide a means for introducing very detailed information about the workings of a system much like the relationships used by Kottke in shifting supply and demand parameters over time.

Clearly, no one model can be recommended for all policy problems. However, with our growing knowledge of systems simulating models and highspeed computing capability, there is no longer any excuse for vague generalities in the analysis of welfare effects of agricultural development policies and programs.

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Discussion: B. DELWORTH GARDNER, Utah State University

I am sympathetic to Professor Bawden's attempt to analyze the welfare implications of poverty programs. For too long it has been assumed that such programs were outside the scope of economic analysis, that pure transfers do not contribute to increasing the national income. Bawden's useful insights make it clear that aggregate utility may well be enhanced by poverty programs.

He argues that poverty programs are characterized by the fact that dollar costs exceed direct dollar benefits because of administrative costs. Therefore, traditional welfare economics is certain to show poverty programs infeasible in the efficiency sense, since gainers must compensate losers if an unambiguous improvement in aggregate welfare is to be demonstrated and not enough gains will be generated to do this. A possible way out is to assume a social welfare function that permits interpersonal comparisons of utility. But since interpersonal comparisons are proscribed by the "new welfare economics" of Lord Robbins and others, we must have a substitute framework.

Bawden finds it in an aggregate utility function that assumes interdependent individual utility functions. Donors of welfare aid receive utility by giving up resources to needy receivers who also receive utility by receiving and consuming these resources. To judge feasibility, the demand prices for both donors and receivers for various quantities of welfare payments must be summed and compared with the costs of supplying these quantities. In this framework, it is quite possible that the utility gain from the transfer will exceed the loss.

I quite agree that regarding the donors as well as the receivers as gainers is a useful notion that is correct over the voluntary part of giving. If the utility gains can be measured, our traditional benefit-cost analysis is as applicable to poverty economics as to any other kind. In this context, poverty aid is best regarded analytically as a joint product. Donors give up resources to buy utility for themselves as well as for receivers.

Several caveats seem warranted, however. Donors will supply resources voluntarily so long as their marginal utility of giving exceeds their marginal opportunity cost of parting with the resources. Some net utility thus must be added to the utility of the receivers. If the transfer cost is zero, the optimal transfer (from the point of view

of the donor) will always fall short of the social optimum, if the receiver also gets utility from the transfer. The social optimum is easy to determine in principle. Marginal social benefits must equal marginal social costs. Marginal social benefits equal the net marginal utility of the donor (the difference between the marginal utility of giving and the marginal value of his foregone use of the resources) plus the marginal utility of the gift to the receivers. The marginal social cost is the cost of making the transfer. If the government is responsible for making the transfer, the donor sees only his marginal utility of giving. He does not internalize the utility of the receivers or the transfer cost.

Let us assume that society desires the social optimum level of giving and is willing to force this level. If the transfer costs are less than the utility of the transfer to the receivers (hopefully a valid assumption), the social optimum will require the donors to give more than they would voluntarily. They then would regard themselves as net losers, and we are back to the gainer-loser problem of traditional welfare economics. Bawden's interdependency hypothesis does not permit us to escape the problem of making interpersonal comparisons. It seems to me that Bawden misses this point.

In the real world, of course, our poverty programs are financed with resources acquired by taxation, not by voluntary giving. Let us analyze this from the viewpoint of the donor. If the resources are acquired by taxation, there is a strong presumption that the taxpayers would not have given up the resources voluntarily, which implies that they regard themselves as net losers and not gainers. We find ourselves once again in the gainer-loser dilemma pointed out in the preceding paragraph.

By a different rationale, however, citizens may vote to tax themselves for poverty programs even if their net utility from giving the amount required is negative. There may be salutary externalities from these programs quite apart from the utility functions of the donors and the direct receivers. Poverty programs may reduce crime, enhance human productivity because receivers may avail themselves of better education and become better citizens, etc., none of which may be reflected in the utility schedules of donors and receivers. If these externalities are significant, the socially optimum level of transfer is increased,

but the donors will increasingly regard themselves as losers when considering only their utility from providing taxes.

I also think Bawden may be too pessimistic in faulting his theory. (1) He argues it is too simple to deal with large numbers of givers and receivers. It is true that these interdependencies are complicated, but it may be quite sufficient to deal empirically with *classes* of donors and receivers. (2) Receivers may also be givers. Yes, but their utilities as givers and receivers can in principle be analyzed separately. (3) Some receivers should be weighted more heavily than others because they are more vocal. Of course, then the donors probably receive more utility by paying the price to keep them quiet. It is still a question of pricing both utility functions. (4) The theory ignores the transfer demands of congressmen and administrators. Yes, I agree that this is a serious problem. When the demand prices of the donors and receivers cannot be measured directly but must be inferred from the actions of their elected representatives (who have demands for transfer programs of their own), then the probability of making estimation mistakes of grand proportions is indeed large.

This brings me to the important empirical problem of estimating the demand price. I am very uncertain as to how to do this without more evidence. It does not matter much whether a donor is buying eternal life insurance with his good deeds or is trying to rid his town of unsightly housing, we must be able to find a way to value his utility from giving, if Bawden's scheme is to work.

(1) He suggests regressing a time series of amounts transferred against prices, both of which are available. But it is not clear to me what the prices are in such a series with respect to demand. Conceptually, these prices should be the value of the utility a donor derives from giving. Administrative costs of poverty programs clearly will not do; nor will market prices of the goods and services that receivers purchase with transfer funds, although these are obviously useful in estimating receiver demand prices.

(2) The same problem exists with cross-sectional regressions. But here we must also confront the problem of assuming identical preference functions in all arguments for people everywhere, except for price and income, if these are the elasticities in which we are interested.

(3) Bawden argues that studying private charity would help establish preferences for giving

since at least this activity is voluntary, and I would agree. But as I have pointed out, this approach may not take us far when transfer resources derive from taxation and when the amount of poverty aid is not socially optimal.

Despite these critical problems, I believe Bawden has made an important beginning in this paper, and I congratulate him for his effort.

I found less to challenge in the Bieri, de Janvry, and Schmitz paper (hereafter referred to as BJS) probably because they were tracing more familiar ground. The sections on general equilibrium and the nature of agricultural technology were useful, although the work has been done before. In general the middle part of the paper is a nice framework for analyzing the effects of technical change.

I do not, however, completely agree with their discussion of the relationships between the distribution of gains from technical advance and market structure, which were presented at the beginning and again at the end of the paper. They clearly imply that, because the inventors of technology are imperfectly organized, "farmers have relatively little to say, given that the investment in new inputs is profitable, in both the type and the amount of technology made available to them."

The emphasis is wrong. A more accurate description of reality is the statement turned on its head. The opportunity for invention is inherent in agriculture, and because agriculture is a competitive industry, the pressures for rapid innovation are enormous. It is this competitive pressure to innovate in agriculture that generates the continuing supply of inventions to agriculture from "outside" public institutions, machinery manufacturers, and chemical companies.

Any entrepreneur in a competitive industry *knows* that profits from innovating are bound to be short run, and, if he is to share in these profits, he must be quick. There is a veritable flood of innovation, even though the long-run equilibrium might be worse for nearly all producers than if no innovation had taken place.

It seems to me that BJS misinterpret the meaning of all of this. They hypothesize that farm size will be determined "by the rate at which the machine companies manufacture larger and larger equipment." They even cite the parallel between this situation and the Galbraithian notion of the domination of consumers by opinion makers and advertisers. Surely this puts the cart before the horse. It is the latent profits in

technical advance and the economies of scale in competitive agriculture that call forth certain inventions, rather than greedy monopolistic machine manufacturers forcing bigger machines on a reluctant agriculture.

But what has all this to do with the distribution of benefits that result from agricultural technology? That the differences between BJS and me are more than mere quibbling is obvious in their discussion of the green revolution. They make three points: (1) for an invention to come about (e.g., dwarf-wheat seeds), either a monopoly or a public agency must have existed; (2) the suppliers of inputs are the gainers from technological change; and, (3) it is doubtful whether or not consumers benefit.

Relative to point one, it is granted that some degree of monopoly power is needed to exploit the profits from an invention. Our patent system gives an inventor this monopoly power for a short time. But even if the inventors are monopolists, the relevant question for distribution issues is: can they maintain it long enough to extract all the economic surplus the invention produces? The green revolution and dwarf wheat provide a beautiful example of how difficult this often is. These seeds are used all over the world, and their supply has escaped the control of the Rockefeller Foundation and the Mexicans.

Many suppliers of inputs such as irrigation equipment, fertilizer, pesticides, etc., have undoubtedly earned profits through the green revolution. But the distribution of gains among producers and consumers brought about by technology advances is an empirical rather than a theoretical matter. BJS seem to argue that, because these suppliers tend to be monopolists, they will vigorously push technological advance, and their gains will be relatively large. I am not so sure. Just as in American agriculture, given the supply of inventions, the more competitive the supplier industry, the greater the pressure to get in first with the new seeds, fertilizer, etc. The presence or absence of monopoly power does not guarantee a profit. The gains captured by the supplier depend on whether he is the inventor or only the distributor of the invention.

Finally, I know of no empirical evidence that supports the conclusion that consumers have not benefited from the green revolution. My own observation of its effects in Latin America would suggest that they are the principal beneficiaries. In my opinion food prices are much lower than they would have been without the impetus to

production exacted by the introduction of the dwarf wheats and all the other complementary inputs.

Obviously, distribution of the economic surplus resulting from technological change is related to market structure. But I would not go so far as to say that "present-day farmers are, to a large extent, working for the banks and for chemical and machinery manufacturers."

If I were to summarize the message of the center part and substantial sections of the paper, my conclusions would be quite different from those of BJS. I would be influenced by the prejudices I personally carried into reading the paper (just as they were while writing it), namely, that the owners of factors of production with inelastic supplies, generally land, will capture the bulk of any producer's surplus generated by technical advance. But I also contend that consumers will capture surplus, too, especially if their demands are highly inelastic.

Sectional Meeting B

APPLIED WELFARE ECONOMICS

Subsection B.1—Contributed Papers

Chairman: JURG BIERI, University of California, Berkeley
Papers: Choong Yong Ahn and Inderjit Singh, Ohio State University, "Distribution of Farm Incomes Under Alternative Policy Regimes: A Dynamic Analysis of Regional Development in Southern Brazil (1960-1970)"

R. W. Herdt and E. D. Kellogg, University of Illinois, "Evaluating the Welfare Effects of Policies for Agricultural Development: An Application of General System Simulation to North Indian Agriculture"

Gordon Rausser and John Freebairn, University of California, "Estimation of Social Preference Functions for the Analysis of Economic Policy Problems"

T. Takayama, University of Illinois, "Temporal Price Equilibrium Models and Optimal Control Models"

Joe B. Stevens, Oregon State University, and E. Bruce Godfrey, University of Idaho, "Use Rates, Resource Flows, and Efficiency of Public Investment in Range Improvements"

Subsection B.2—Contributed Papers

Chairman: PAUL BARKLEY, Washington State University
Papers: V. V. Sharma, Ohio State University, "Corporate Economy and Public Welfare"

Jae H. Cho, University of Notre Dame, "Rehabilitation of the Pigovian Tradition"

Paul W. Barkley, Washington State University, "The Orientation of Agricultural Experiment Station Research with Reference to the Distribution of Income"

Thomas A. Carlin and E. I. Reinsel, FPED, ERS, USDA, "Combining Income and Wealth . . . An Analysis of Farm Family 'Well-Being'"

Edward I. Reinsel and Thomas A. Carlin, FPED, ERS, USDA, "The Personal Distribution of Income and Direct Farm Program Payments"

Subsection B.3—Contributed Papers

Chairman: PAUL HUSZAR, Colorado State University

Papers: Anthony M. Tang and Craig C. Wu, Vanderbilt University, "Education and Distribution of Its Benefits in Agriculture: A Comparative Study Under Varying Technical and Market Conditions"

James W. Gruebele and Lyle P. Fettig, University of Illinois, "The Distribution of Benefits of Public Policy

Among Milk Producers"

Robert E. Jacobson, Ohio State University, and Truman Graf, University of Wisconsin, "Resolving Equity Problems in Grade B Milk Conversion and Low Class I Utilization"

Tirath R. Gupta, University of Massachusetts, "Economic Criteria for Decisions on Preservation and Use of Inland Wetlands in Massachusetts"

Sectional Meeting C

COMMODITY TRADE IN THE 1970'S

CHAIRMAN: KENNETH E. OGREN, FAS, USDA

The Policy Environment for U. S. Agricultural Trade*

GARY L. SEEVERS

THE New Economic Policy (NEP) announced one year ago came at a time when there were serious conflicts between the objectives of macroeconomic policy and the means of achieving those objectives. The performance of the economy—measured in the macro variables of aggregate economic activity, inflation, and the balance of payments—was unsatisfactory. But at the same time the conventional tools of fiscal and monetary policy that would help the economy achieve one objective would worsen the situation for one or both of the other objectives. The combination of domestic unemployment and inflation far beyond the boundaries of recent experience and a deteriorating balance of payments are well known even if the current state of knowledge does not allow economists to explain them fully.

The unexpected "freeze" of domestic prices and wages was combined with equally surprising and provocative international policies. It has been stated that the announcement to suspend the dollar's convertibility into gold and other reserve assets marked the end of an old international monetary order that had become subject to one crisis after another and initiated reforms necessary for an improved monetary system [7, p. 142]. But the NEP may well have signaled a basic revision of U. S. international economic policy in much broader terms as well.

Old Beliefs and New Realities

Economic policy is formulated in a world of political pressures. Just as the adoption of new domestic policies had important political dimensions, emerging attitudes toward overall foreign policy have played an important part in the willingness of policymakers to redirect the international economic policies of the United States.

* The views expressed in this paper are those of the author and should not be attributed to the Council of Economic Advisers.

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Since World War II economic policy has been to a major extent the stepchild of broader foreign policy objectives, particularly national security. The belief that communist aggression existed and threatened U. S. interests caused national security considerations to dominate economic policy [1; 5, pp. 21-25]. This belief gave rise to the Marshall Plan and subsequent mutual security efforts in Europe and Asia. It provided the underlying support for foreign aid programs to developing nations. It fostered U. S. support for the European Community even if that support translated into acquiescence in bearing economic costs such as reduced demand for agricultural products. The belief about communist aggression probably influenced the U. S. negotiating posture in the successive rounds of trade negotiations. It certainly resulted in a variety of prohibitions against normal commercial relations with Communist-bloc countries.

In recent years the rationale for placing national security so much above economic considerations appears to have modified. This is evidenced in several ways: an erosion of support for foreign economic assistance; a crescendo of criticism about inward-looking policies adopted by the European Community, especially as its membership and affiliations mushroom; growing resistance to the continuation of Japan's restrictive import policies; and, perhaps most revealing, preliminary steps toward expansion of commercial relations with Communist-bloc countries. In short, there are signs that U. S. international economic policy is becoming more self-serving in economic terms and less subjugated by traditional national security policy.

The trade deficit

While national security was influencing the course of U. S. international economic policy, important economic developments were taking place. The European Community and Japan were each emerging as economic entities on a par with the United States which had been unrivaled as the world's largest economic unit in terms of to-

tal output. The output growth abroad during the 1960's was accelerated by the achievement of economies of scale in industry and higher rates of investment in the production of private goods than in the United States. Producers abroad were improving their competitive position relative to U. S. producers, especially for consumer goods in the U. S. market.

Economic developments in the United States were working alongside foreign developments to reduce the competitive position of its producers. Beginning in the mid-1960's, U. S. resources were approaching full employment with a large share allocated to defense-related activities. Achievement of full employment from 1966 to 1969 placed direct pressures on the capacity to supply exports and raised the demand for imports. It also initiated classical demand-pull inflation that influenced trade flows during that period and since then.

Without a monetary system in which the exchange rate of the dollar could respond to new circumstances, the predictable result of these economic developments was a sharp deterioration in the U. S. trade balance and increasing incentives for U. S. firms to expand their investments abroad. Both developments have had a significant influence on the policy environment in the United States.

The U. S. trade balance was recording a surplus of \$4 to \$6 billion during much of the 1960's. But in the 1968 to 1970 period this surplus began to disappear and in 1971 turned into a large deficit. Some would argue that a trade deficit is no cause for alarm. The trade account is only one component of overall external balance, and a deficit can be offset by a surplus on other accounts. In particular the United States receives more than \$6 billion of income each year from earlier foreign investments that were counted as an outflow at the time. On the other hand, others would argue that the United States has major payments outflows that result from commitments for foreign assistance and mutual security costs, as well as additional net private investments each year. These appear to be sufficiently large that a trade surplus will be required to achieve a satisfactory balance of payments in the years immediately ahead [7, p. 167].

The steady disappearance of a trade surplus since 1968 has particularly serious implications if a substantial surplus is required for a satisfactory balance of payments. Prolonged disequilibrium exchange rates that cause an overall trade imbalance also place extra pressures on margin-

ally competitive U. S. industries that would be able to compete in equilibrium. Domestic dislocations ensue that are undesirable in terms of economic efficiency. In this way a rigid monetary system can create unnecessary economic dislocations and can erode political support for liberal trade policies. The deficit that emerged in 1971 became a highly visible signal in the political environment that new policies were needed. It provided an extra catalyst to protectionist sentiments that were already strong in the Congress and the Executive.

Jobs and trade

The emergence of a trade deficit and the growth of foreign investment by U. S. corporations are part of a larger group of developments that have made "American jobs" a primary factor in the policy environment. Many representatives of labor no longer support a liberal trade policy. Organized labor represents only one-fourth of the workforce, but its defection is nevertheless the most significant single factor in the erosion of support for free trade. Surprisingly, the evolution of organized labor's new position through the late 1960's was almost perfectly correlated with the steady decline in the unemployment rate in the United States.¹

While it is difficult to appreciate how liberal trade policies cost Americans jobs in a period of low unemployment, the increased rate of unemployment that emerged in 1970 certainly aided those who wanted new restrictions on imports into the United States. The Congress came close to enacting trade legislation that would have placed broad new restrictions on imports. Fortunately, the 92nd Congress adjourned without passing restrictive trade legislation. The United States has, nevertheless, taken several specific actions in recent years to restrict politically sensitive imports. Thus, even without actual enactment of import-controlling legislation, the pressures have crept out in other forms.

¹ An interesting discussion of organized labor's defection is given by Bergsten [1]. He argues that organized labor has become more interested in avoiding dislocations than achieving higher incomes for the average U. S. worker through expanded trade. This position is partly explained by the fact that the strength of organized labor is relatively small in nontraded goods (most services) and in industries for which the United States has a comparative advantage—high technology products and agriculture. Bergsten points out that, unfortunately, other interest groups (agriculture, consumers, multinational corporations, and smaller exporting firms) do not appear to have sufficient political clout to offset labor's defection.

In summary, new attitudes toward national security policy, the emergence of a trade deficit, and the prime attention to jobs have all converged to alter the dynamics of the policy environment for international economic policy.

Neo-Isolationism

The present fluid environment could create a new political basis for a multilateral approach to economic policy, although the form would be unlike the U. S.-dominated multilateralism of the past. Or, it could lead U. S. policy toward a period of neo-isolationism in which actions in this country encourage a world of discriminatory economic blocs. Europe is already well along the road to a large Eurobloc that may be the dominant factor in future world trade. Japan is the major force in the Pacific region with expanding special arrangements with other countries. The existing Soviet bloc remains essentially a closed arrangement although its future identity is becoming less clear. The United States might become part of a North American bloc. Developing nations would face the difficult choice of either aligning with one of the blocs dominated by industrial countries or remaining on the outside.

The economic implications of a world of trading blocs would depend on the degree of discrimination they practiced. If current trade and investment restrictions between blocs were gradually reduced and intra-bloc restrictions were eliminated, the economic distortions might be of rather small magnitude. But if, as a part of bloc formation, new restrictions were introduced in order to give preferences to exchange among members of each bloc, the economic consequences would be great. Based upon the Common Market experience with agriculture and the excess agricultural productive capacity in many developed countries, such a scenario would have major implications for U. S. agriculture.

The agricultural sector in most industrial countries is adjusting with a certain lag to the same economic forces as U. S. agriculture. The typical political response to this phenomenon, whether it is occurring in agriculture or in other industries, is to adopt measures that buffer and retard adjustment rather than assist it. It seems probable that member countries would try to offset the internal adjustment problems that bloc formation would create for agriculture by taking actions that would discriminate against imports from third countries. For the United States, especially if it formed a bloc with Canada and Mexico, agriculture would have a distinct

comparative advantage. However, this advantage would remain unexploited and conceivably to an even greater extent than it is today.

Multilateralism and the NEP

The course of economic relationships among countries in the next decade will not be determined solely by U. S. policy. Nevertheless, decisions made in the United States can help restore the trend toward dismantling trade barriers on a nondiscriminatory basis—a trend that has reached a standstill and may have reversed since the Kennedy Round of negotiations.

The NEP may have helped open doors toward restoring the liberalization trend. It certainly dramatized the problem facing U. S. policy. After several months of unsettled conditions, some symbolic and real progress was achieved. On the monetary side, the Smithsonian Agreement was significant because, for the first time, a large group of countries collaborated in establishing a set of new exchange rates. The agreement also improved the competitive position of many U. S. industries and will eventually reduce the trade deficit. As this occurs, one of the pro-isolation factors in the U. S. policy environment should diminish. The expansion of the U. S. economy that is now underway has increased employment and is beginning to reduce the employment rate. This may diminish the pressures to mold trade policy as if it could create more domestic jobs on a sustained basis.

Monetary reform

The short-term realignment of exchange rates in the Smithsonian Agreement was needed to correct a fundamental disequilibrium for the dollar. But the most important part of the Smithsonian Agreement may be the commitment to reform the monetary system itself.

Economists point out that there are important advantages to a monetary system that allows for macro adjustments to achieve external balance. Macro adjustments reduce the necessity and the political pressures to adopt micro trade and investment policies that interfere with resource allocation in order to achieve equilibrium in the balance of payments.

The advantages of a more flexible exchange rate system are persuasive and support the view held by some "purists" that the monetary side should receive top priority in the forthcoming talks. According to this view, once a well-lubricated monetary adjustment mechanism is in place, the trade balance argument for restrictive

trade policies will be gone, and trade liberalization can move forward based on the gains from trade, irrespective of its impact on the balance of payments. Unfortunately, more flexible exchange rates are not the whole answer. Quantitative restrictions often arise from micro domestic probableness of changes in exchange rates because they isolate certain sectors from the adjustment process. The pressures for quantitative restrictions often arise from micro domestic problems that do not depend on whether or not there is an external imbalance. A new monetary order would not affect these pressures very much. Therefore, a linkage between monetary and trade talks is desirable.

Agriculture is a prime case where monetary reform would have little effect. U. S. agricultural exports and imports will not be materially affected by changes in exchange rates. They are determined essentially by internal agricultural programs that have little, if any, relationship to the status of the balance of payments. Trade liberalization in agriculture will require more than just an improved monetary system, regardless of how important that is in its own right.

In contrast to the purists, there is another view that trade policy should be relied upon to improve the trade balance. Proponents of this view believe that the United States has suffered from restrictive policies abroad, poor bargains in previous trade talks, and heavy mutual security costs. Therefore the trade talks should seek "unbalanced" packages which will improve the U. S. trade position. This group also argues that more flexible exchange rates are either undesirable because they create excess uncertainty or unlikely to be achieved in the monetary talks because other countries do not really want a system that adjusts more promptly.

To the extent that unbalanced agreements could be reached that simultaneously lower foreign and U. S. barriers to trade, the second view would have much to commend it. Certainly, U. S. agriculture would be a likely candidate to benefit from the unbalanced approach to trade talks. However, adherence to this view could close the door to trade talks altogether if other countries resisted such an approach, as I would expect them to do.

Trade Negotiations

This brings me to future trade negotiations—the main door that the NEP opened for U. S. agriculture. Despite the impressive progress in lib-

eralizing industrial trade over the past 35 years, relatively little has been achieved in agricultural trade. The importance of engaging in major trade negotiations to prevent a reversal of progress was emphasized in the timely and comprehensive report on U. S. international trade and investment policy released a year ago by the Williams Commission [2].

In the months after the NEP was announced, joint declarations were reached with the European Community and Japan that committed both sides to prepare for trade negotiations in 1973. For the reasons given earlier, the policy environment in the United States is not ideal to enter trade negotiations. In addition, the political process is always highly asymmetrical with respect to trade liberalization because the benefits of free trade are widely dispersed and the costs are highly visible to special interest groups. The combination of a new environment and this normal bias toward special interest groups makes the path toward trade negotiations a very hazardous one.

In some respects economists have failed to educate the public on the net benefits from imports.² Much emphasis has been placed on static efficiency gains from trade. It is easy for the public to appreciate why the United States benefits from exporting grain and importing coffee, but it is much more difficult for the public to see the gains from importing fresh vegetables from Mexico instead of producing them domestically.

Much less attention has been given to dynamic gains from free trade. Imports provide desirable competitive pressure on domestic industries that discourages them from abusing economic power and encourages them to be innovative. There can be little doubt, for instance, that automobile imports have played an important part in the performance of the domestic automobile industry. Imports often cultivate unexploited markets by providing new or low-cost products, as well as luxury ones, and thereby give consumers greater variety. Imports provide a valuable brake on rising prices in inflationary periods. In the end, imports generate economic activity abroad that provides the purchasing power to buy those products which can be produced efficiently in the United States. In light of these benefits, a strong case can be made that liberal import policies are in a

² Hathaway [3] has presented the case in favor of liberal import policies from the standpoint of consumers.

country's own interest and should not be contingent on concessions abroad.³

Income distribution

Economists have paid practically no attention to the relationship between trade and income distribution which lies at the center of protectionist sentiment. Recent empirical and theoretical work has helped to clarify the nature of U. S. comparative advantage and one of the important linkages with income distribution.

The older view held that U. S. resource endowment should provide a comparative advantage in capital-intensive rather than labor-intensive products and certain products for which this country has an ample endowment of natural resources. In the new model, U. S. comparative advantage is principally in products having a large component of human-capital inputs. Human capital can take many forms: high-quality management, R&D activities, and skilled manpower in the actual production of high-technology products. Wage rates or other more sophisticated measures serve as proxies for measuring human-capital intensity. Conversely, those products that require low-skilled workers are the ones in which this country has a comparative disadvantage. It becomes fairly evident in this new model that trade liberalization will, in the short term, increase the demand for skilled manpower and decrease the demand for low-skilled workers in the United States. Indeed, it is this very process that causes higher real earnings for labor in aggregate. However, as income earners, lower paid workers would receive smaller relative wages after liberalization (and a few may become permanently unemployed), while better paid workers would receive larger relative wages.

There will also be distributive effects on the real earnings of labor, as consumers, because of changes in relative prices. I would hypothesize that low-income consumers would benefit from trade liberalization. Many low-skill products, for which relative prices would decline, are also basic consumer goods. This hypothesis needs further examination, however. It is not at all clear, for example, that trade liberalization would cause lower relative food prices in the United States. Reduction of barriers to agricultural trade, which on balance reduce net U. S. exports, would ex-

pand demand and raise farm and food prices.

A leading issue in trade negotiations will be how to deal with trade restrictions (principally quotas) that, if removed, would have prompt and substantial distributive effects. Rapid penetration of imports into domestic markets can create genuine adjustment problems which most countries are unwilling to impose on workers and industries today. This has been tagged the issue of "market disruptions."

Agriculture and trade negotiations

Agriculture is a specific case where trade liberalization could have major distributive effects since trade barriers are part and parcel of domestic policies which have had enormous income-transfer effects [4]. It is for this reason that agriculture presents the major challenge to successful negotiations. U. S. officials face particularly difficult decisions in this regard. On the one hand, it is clear that this country is a low-cost producer of many agricultural products. Relatively little work has been done on the question of how agricultural trade flows might be affected in a free-trade world. The available evidence indicates that demand for high-technology products—grains and soybeans—could expand materially. In addition, the United States might become an important exporter of high-grade beef because of changes in relative prices in Japan and Europe that would result from trade liberalization. Therefore, free trade in the important feed-livestock sector could have major effects on exports and, in turn, on domestic farm prices, incomes, and government programs.

On the other hand, the dairy industry is not a high-technology part of U. S. agriculture. Dairy producers and handlers would experience reduced demand for that part of their output used in manufactured dairy products. Whether the implied income reductions and adjustments should be compensated and in what ways is an important political and welfare question. Similar issues arise with respect to producers of certain other farm commodities that have benefited from protective policies.

In light of the potential net benefits to the U. S. economy and to the agricultural sector from trade liberalization, several issues face U. S. officials: To what extent should protective U. S. agricultural policies (like the dairy program) be subject to negotiation? Should negotiators be willing to make concessions in the industrial area in exchange for progress in liberalizing agricul-

³ Schnitzler [6, p. 904] proposed a similar strategy for agriculture: reform of U. S. farm programs to achieve domestic objectives should not await similar actions abroad.

tural trade? Given the low probabilities of negotiating a meaningful agricultural package, are the potential costs in terms of reducing the chances for fruitful negotiations in other areas worth the substantial benefits to agriculture if negotiations were successful?

I have identified two of the most controversial aspects of upcoming trade negotiations: market disruptions in general and agriculture in particular. How these should be dealt with will be an important subject in preparing for negotiations and in the actual negotiations. In addition, there are the traditional problems of tariff-cutting; a variety of troublesome non-tariff barriers in addition to quotas; the new environmental policies that can be expected to have trade effects; and the forum and format for the negotiations themselves. The combination is large and will require a much different and more comprehensive approach to negotiations than has been followed in the past.

Conclusion

How will U. S. agriculture fare in today's fluid trade policy environment? The answer is, it depends. Assuming that the forceful national secu-

rity basis for liberal U. S. trade policy is gone, then the status quo would seem to be the best that could be anticipated until a trade surplus is restored and the unemployment rate declines further. Few changes can be expected in agricultural trade policy that would benefit U. S. exports during this holding action. If the fluid U. S. policy environment coupled with pressures in other countries carry nations down a route of neoisolationism, either by default or by explicit actions to encourage discriminatory trading blocs, the implications for U. S. agriculture would be enormous and negative. On the other hand, progress in monetary talks and comprehensive trade negotiations would lay the basis for a constructive new approach to multilateralism with the possibility of real gains for U. S. agriculture. But even if a new form of constructive multilateralism prevails, the gains are by no means assured. They will depend on the ability and willingness of officials in all countries to place their agricultural programs on the negotiating table. The pressures that have caused protective agricultural policies in the United States are the same ones that exist abroad. They will make liberalization of agricultural trade one of the most intractable problems in the upcoming negotiations.

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World Trade Prospects for U. S. Agriculture*

QUENTIN M. WEST

SINCE the 1930's when the United States embarked upon a course of promoting free trade, U. S. and world agricultural trade has greatly expanded with successive reductions of tariffs via negotiations. Advancing through the 1970's, we still have tariffs but these are not the major trade constraints. Today non-tariff barriers are the chief inhibitors to world trade.

With this new awareness which the President dramatized in his August 1971 New Economic Policy announcement, the world has now set upon a new course of negotiations aimed at solving highly complex monetary and trade problems. These result from a decade of rapid economic growth, emergence of domestic and international trade policies of individual countries, and recently established trade blocs which conflict with free trade goals.

An irony of agricultural modernization of the post-World War II era has been that, while we increased incomes and productivity, we also erected non-tariff barriers which restricted international movement of the benefits of this new productivity. In the pursuit of increased farm incomes, various income and price support programs were instituted in developed nations to deal with imbalances created by rising productivity. To realize the full domestic benefits of these programs, countries or blocs of countries instituted export subsidies, variable levies and import quotas, and other non-tariff devices. While such programs contributed to improved farm income, they also became barriers to the free flow of goods among nations.

Much progress in eliminating trade barriers has been made. While many tariff problems remain, the difficult problems as we enter further GATT negotiations will be those involving non-tariff barriers. This arises because it necessarily involves negotiations on domestic issues in the international arena. For instance, to what extent can domestic price support programs which can restrict trade be brought into international talks?

An emerging and vital economic research area lies in identifying those domestic policies which

will achieve critical national objectives while minimizing undesirable effects on trade. Nations committed to unhindered trade must have clear economic options so that the policies they adopt will not conflict with their world trade intentions.

Historical Trends in U. S. Farm Trade

Few U. S. agricultural issues are as meaningful to the American farmers' pocketbooks as those relating to world trade. The Agricultural Act of 1970 is predicated on a growing market including a growing export market. Secretary Butz' landmark journey to Moscow was a practical visit of a farm salesman who understood what increased grain sales could mean to our economy. Too, trade was an important area of discussion later in U. S.-Soviet Summit talks. The July \$750 million grain sale to Russia capped these events.

While declining in overall percentage terms, U. S. farm exports are at an all-time high. One of almost every \$7 of our farm cash receipts comes from foreign markets. Not even the dramatic events affecting our farm trade in 1971—improved grain crops around the world and the port strikes—prevented us in fiscal 1972 from reaching a record of \$8 billion in exports. Some predict \$10 billion in exports possibly by or before 1980. Later, we will explore the conditions under which this could happen.

The favorable U. S. agricultural trade balance—about \$1.9 billion in 1971—takes on special significance in helping to overcome the \$3.9 billion trade deficit in nonagricultural goods that same year.

Patterns of trade [5]

Events of the post-WW II years have generated significant shifts in world agricultural trade patterns:

* Rapid economic growth in developed regions has spurred demand for food-producing imports such as feed grains and other livestock feeds. This contrasts sharply with the heavy import emphasis on agricultural raw materials such as cotton, wool, jute, hard fibers, and rubber which characterized the 1920's and 1930's (Fig. 1).

* This demand shift has altered trade patterns between nations and has revised export prospects for particular commodities and nations.

* The author appreciates the assistance of Anthony S. Rojko, Arthur B. Mackie, and James Sayre, Economic Research Service.

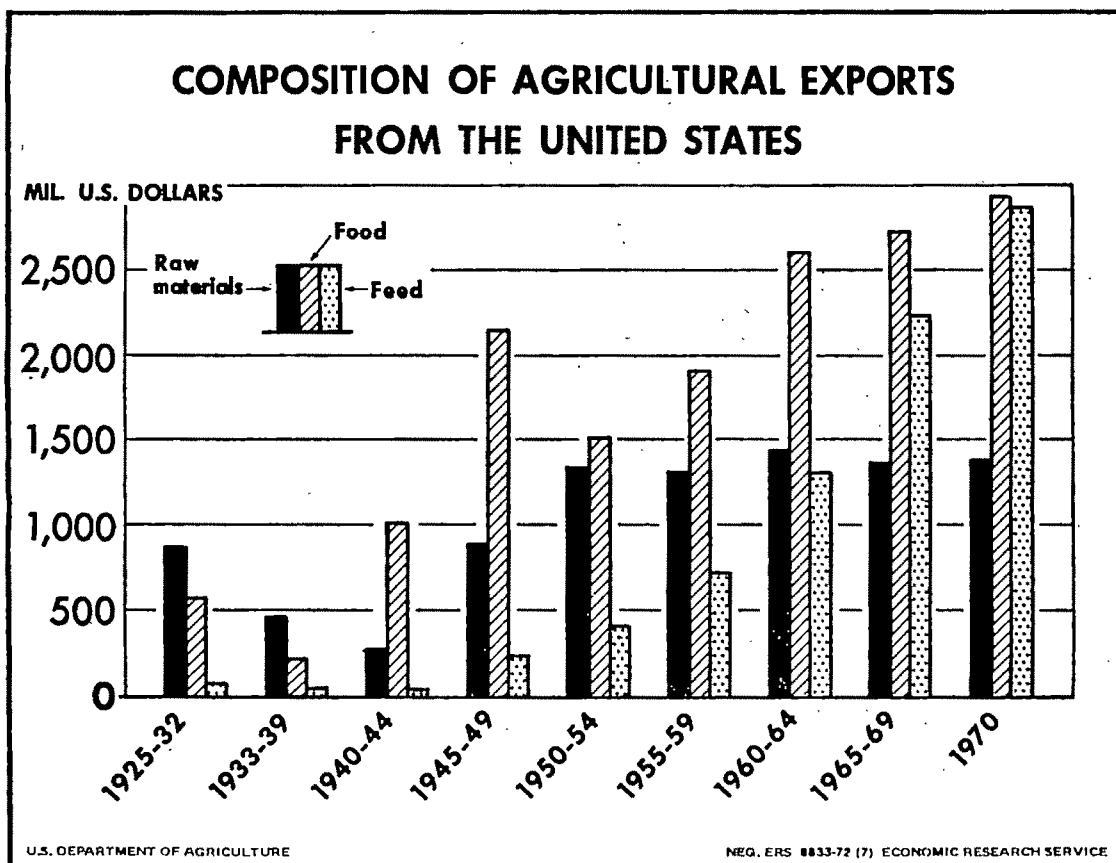


Figure 1

* The real phenomenon in this period has been the advent of trading blocs, most especially the EC.

Nations with established productivity, trading expertise, facilities, and opportunities are better able to adjust to recently changing trade conditions. Others, especially developing nations, are hampered by a lack of export experience, low productivity, slow economic growth, and other factors which stymie adjustments.

Influenced by these conditions, much world trade in farm products is among developed nations—recently about 55 percent of the exports and 71 percent of the imports. Trade is one-directional, from major exporters (United States, Canada, Australia, and New Zealand) to major importers, mostly Western Europe and Japan. The United States, largest single farm exporter, accounts for a sixth of the world's farm exports while the EC is the largest importer—about a third of the total.

The developing nations' (excluding Israel and Argentina) participation in world farm trade is

slackening. While agricultural exports by developing nations rose from \$13.5 billion in 1955 to \$16.5 billion in 1969, their world share fell from 45 to 33 percent. Reasons were several:

* As pointed out earlier, there is a shift in overall farm trade from agricultural raw materials, largely products of low-income tropical agriculture, to food and feed.

* For tropical exports—cocoa, coffee, tea, bananas—demand growth does little more than parallel population growth in importing nations. Too, productivity has generated intense competition among developing nations, exerting downward pressure on prices.

* Developing nations are largely excluded from the growing beef market in developed nations which have raised barriers on the grounds of protectionism and quite legitimate problems such as animal disease. Moreover, the related world feed grains market has limited opportunity for developing nations because of low productivity.

* Developing nations have been too pre-occupied with feeding burgeoning populations to be effective in export markets.

The trend for developing nations is to buy less from one another and more from the developed world. They supplied 49 percent of their own farm imports just 15 years ago. Some 46 percent came from developed nations and 5 percent from Communist nations (Eastern Europe, USSR, Mainland China). By the late 1960's, they bought from each other only 34 percent of their farm imports, some 56 percent from developed nations, and 10 percent from Communist nations.

The emerging trade pattern of the centrally-planned nations is similar—intra-trade has grown slowly while trade with other regions has increased rapidly, most especially with the developing nations. The developing world's share of Communist imports rose from 12 to 32 percent since 1955. Communist nations have also increased imports from developed nations.

Developed nations have most readily adjusted to new world market demands, specifically the rapid growth in food and feed trade. These increased about \$17 billion from 1955 to 1969, while nonfood farm raw materials climbed only \$2.5 billion. While U. S. food aid shipments were significant, much of the sharp increase has been in feed grains, oilcake and meal, soybeans, and other feeds. In the early 1960's, about 24 percent of U. S. farm exports was feeds and feed grains; this climbed to 40 percent by 1970. Japan and the EC, accelerating livestock production, were chief customers.

The EC and Japan have had a more rapid growth in imports of feed and feedstuffs than of foods and agricultural raw materials. While EC food imports rose 8 percent annually during the 1960's, yearly feed imports climbed nearly 10 percent. Japan's feed imports in the same period raced upward about 19 percent a year while food imports lagged at about 11 percent.

These shifting trade patterns have been summarized by Mackie [5]. These shifts have: (1) increased the developed countries' market share in all three economic regions; (2) decreased the developing nations' market share in the developed countries; (3) made the developing nations more dependent upon agricultural products of the developed countries; (4) increased the dependency of the central plan countries upon world supplies of farm products; and (5) effected a substitution in world markets of developed countries' farm products for those from the developing nations.

Major Issues Affecting U. S. and World Trade

New rules affecting monetary and trade flows between countries will no doubt be the overriding issues affecting trade and its expansion. Groundwork for negotiating both new monetary and trade rules is now being laid. An important issue to be resolved before negotiation can begin is the question of tying trade negotiations to the development of a new monetary system.

Resolution of this question may well determine the success in dealing with the major trade policy issues in the 1970's—non-tariff barriers. Any new monetary system designed to restore equilibrium in the capital markets cannot be successful if trade policies are used to distort the exchange system, the competitive position of various producers, and, thus, the long-term trade flow of goods and services, which set up conditions for disequilibrium.

In short, the old rules governing monetary and trade systems of the post-war years, which created the disequilibrium of the 1960's, must now be replaced with an integrated monetary and trade system that will restore international equilibrium and the necessary conditions for continued long-term economic growth of the United States and, indeed, the world.

The recent rise in protectionism and policies to reduce import competition represent major trade issues ripe for negotiation. Results will influence future growth and expansion of U. S. and world farm trade.

Tariffs and quotas

After six GATT rounds of tariff reductions, the inhibiting effect of customs duties on trade has been greatly diminished. Their continued presence is still a problem but not a major threat to free trade.

Non-tariff barriers [6]

Some important economic policies constituting non-tariff barriers are: domestic support programs, export subsidies, domestic consumption restrictions, and preferential trade agreements.

Domestic price and income supports.—Programs and policies have been instituted in the United States, Western Europe, and Japan to assist farmers to survive in a more service-oriented society. These programs generally have been designed more to support farm incomes by supporting commodity prices than to stimulate rural employment or outmigration. Most obvious results of these programs have not been their success in raising farm incomes but in creating sur-

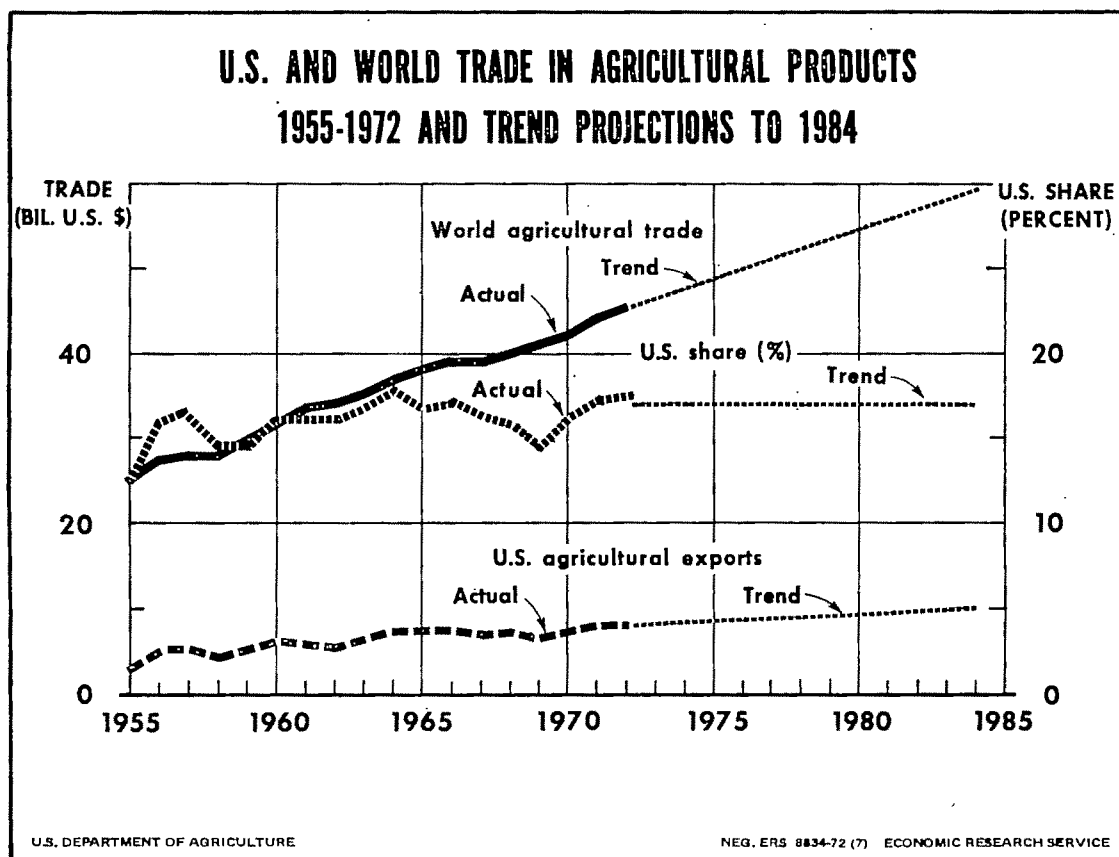


Figure 2

plus production [3]. Surplus production has led to increased protective trade policies and subsidies to protect the domestic production programs. Net result has been to divert trade between countries and cover up true competitive relationships.

The most outstanding example of trade-diverting effects of such policies in the 1970's has been the development of the Common Agricultural Policy (CAP) in the Economic Community. The major issue regarding agricultural protectionism has been the effect of the CAP variable import levies in slowing imports of grains, fruits, and other U. S. commodities while stimulating increases in domestic production of these products for farm income support purposes with prices above world levels.

Income and price support programs of developed nations should be harmonized to reduce their impact upon long-term expansion.

Export subsidies.—Export subsidies are used to help rid developed countries of unwanted products resulting from domestic prices being supported above their equilibrium levels.

Current farm programs of developed nations have resulted in excess production capacity [3]. Resources now engaged in agriculture are capable of producing more than can be disposed of at prices that would yield comparable returns to resources used elsewhere. As a result, governments of industrialized nations have had to engage in trade policies involving export subsidies as high as 300 percent of export prices. In many cases these efforts have been more costly than successful in expanding individual country exports [4].

Domestic consumption restrictions.—Most European countries (including the USSR and Eastern Europe) significantly restrict consumption of many foods through higher prices [4]. There are other programs such as internal taxes and government procurement and distribution practices that restrain imports and insure higher consumer prices.

Preferential trade.—Proliferation of trade preferences by major trading blocs is a major threat to free trade by systematically granting concessions of access in each other's markets. This is an attempt to extend free trade benefits

enjoyed by bloc members to an enlarged world group while systematically discriminating against trade with all other countries.

Prospects For U. S. Farm Exports

President Nixon has called for an annual \$10 billion level of agricultural exports. He did not announce a target date. At least two crucial questions are appropriate: Is the target feasible? When will it be reached?

All forecasts and projections depend on expectations. Some such as average weather cannot be controlled. Others concerning policies and economic relationships have meaning only to the extent they appear feasible. These must be considered when discussing the \$10 billion figure.

The level of exports is the result of a combination of many factors. While exports for a single commodity in a region may vary considerably because of weather, wars, and other special circumstances, the aggregate world values show a steady yearly growth. This trade has grown around \$1.5 billion a year (Fig. 2). Figure 2 also shows growth in value of U. S. farm exports and what is happening to the U. S. share of world farm trade.

If current trends continue, world farm trade could increase to \$55 billion by 1980. If we assume the U. S. share will be 17 percent—the average of the last 2 years—value of U. S. exports could reach \$9.3 billion by 1980. The same procedure would give \$10 billion by 1984. The \$10 billion figure could also be reached by 1980 if our share increased to 18 percent. For most of the past 15 years, the U. S. share has been in the range of 16 to 18 percent. Our share was growing to the mid-1960's but has been somewhat erratic since and possibly declining.

Projecting the trend of U. S. exports directly would give a \$9.5 billion export level by 1980. ERS has a continuing program for making projections with periodic reappraisals of the total export picture. The last complete set of projections to 1980, both domestic and foreign, was made two years ago. We are evaluating these projections and extending them to 1985 and, for some purposes, beyond. Today, I will discuss our 1980 projections.

In July 1970, Culver and Chai [1] published projections to 1980 on U. S. production, consumption, and exports. In this approach individual commodity projections were aggregated and then reconciled into a unified total picture. Their projected exports were based on these assumptions: (1) current world farm trade policies will

continue; (2) no major crop failures; (3) continuation of present food and fiber policies designed for productivity gains will result in a substantial increase in food grain supplies especially in developing countries; and (4) world capacity to produce food and fiber is expected to exceed demand in 1980 at recently prevailing price levels.

These projections indicated farm exports at a little over \$9 billion. The Culver-Chai grain export figure was probably high while the soybean figure underestimated growth in the past two or three years.

During this same period, ERS published a series of demand prospect studies [7]. It included wheat, coarse grains, rice, cotton, and oilseeds. These studies present several alternative projection sets to 1980 for major world regions. The basic set, Set I, might be described as a moderately successful "green revolution." It assumed a continuation of present food and fiber policies in the developing countries and allowed for moderate gains in productivity consistent with some improvements in technology. Another alternative, Set II, could be termed an accelerated "green revolution." It assumed that a higher rate of agricultural productivity and economic growth would prevail in the low-income nations.

Rates of economic growth and agricultural productivity in the developed and central plan areas remain the same under both alternatives. Their current food and fiber policies are assumed to continue. However, continuing policies for the developed exporters include a flexible production, storage, and export policy leading to relatively stable world grain prices. Specifically, the United States and other developed exporters would reduce exports, if necessary, to avoid precipitous price declines. The study also explored the impact on world price if the United States were to carry out a policy of maintaining the same market share in the face of accelerated growth in the developing world under a subset of Set II.

Value of U. S. exports of grain, oilseeds, and cotton under the Set I assumption of moderate growth in the developing world and continuing stable price and trade policies in the developed world amounted to \$5.6 billion in 1980. This was an increase of \$1.3 billion over their level of \$4.3 billion in the mid-1960's and \$0.9 billion over the level of \$4.7 billion in 1970. These projected increases under Set I are comparable for each commodity as projected by Culver and Chai. This demand prospects study also underestimated the demand growth for soybean exports.

In our current projections, we give more emphasis to measuring the impact on trade of changes in national policies (non-tariff barriers). We recognize need for further developing the basic economic relationships to test this impact adequately. However, we are attempting to measure these economic relationships within the constraints of national policies.

We will discuss some of our preliminary work in this area by exploring three sets of conditions: (1) export conditions which would contribute to zero growth; (2) those which would contribute to moderate growth; and (3) those conditions which would significantly accelerate our farm exports.

Zero growth in exports

To put into perspective the full impact of non-tariff barriers on trade, we have made some tentative projections which describe the trade patterns in a world where the major countries achieve increased levels of self-sufficiency through domestic price and income support policies. In the real world, countries fall short of these objectives as trade levels in any year must adjust and interact with policies of other countries. In some ways this set of projections can be looked upon as a possible minimum level of exports that would accrue to the United States. Another view would be that the United States was basically a residual supplier in a world trade environment characterized by increasing protectionism.

This minimum level would be consistent with the following set of pessimistic assumptions: (1) the enlarged EC would be essentially self-sufficient for grains; (2) the expected market for USSR and Eastern Europe would not materialize and this group would be a net exporter of grains; (3) there would be very little growth in the livestock economies in the developing countries; (4) the "green revolution" in the developing countries would proceed at an accelerated growth; and (5) our P.L. 480 commitments would remain at a relatively low level. Given these assumptions, total U. S. farm exports would have difficulty expanding much, if at all, above \$8 billion.

This figure certainly appears contradictory to the expectations based on recent experience. Yet this is the conclusion one can obtain from direct aggregation of results from several studies. For example, a recent Michigan State study [2] on the impact on U. S. agricultural trade of the accession of the United Kingdom, Ireland, Denmark, and Norway to the EC indicates that the enlarged EC could be close to self-sufficiency in 1980 for grains and would have a dairy surplus.

A recent ERS study [8] states that Eastern Europe and USSR combined could be a net exporter of total grains in 1980. Other country studies indicate that an accelerated "green revolution" is feasible and that the cereals picture in the developing world could lead to surpluses, particularly if population is reasonably controlled.

How quickly the livestock enterprise might evolve in the developing countries is uncertain. In particular, because of slow income growth, their policy might be to fortify cereals rather than correct the protein deficiency through increased livestock consumption. Such a policy would slow considerably the growth in the livestock enterprise and would postpone the potential U. S. export market for feed grains which might result from livestock enterprises in low-income nations.

Some growth in exports

Despite immobility in basic domestic income and price support policies, the outlook for the 1970's is not that pessimistic. Even with no major changes in non-tariff barriers, we expect continued growth in world farm trade with the U. S. share continuing. This growth can come about through a modification of some or all of the assumptions associated with the \$8 billion export figure. For example, the enlarged EC might continue to import grain at higher levels than suggested by the MSU study. In spite of rising prices, per capita meat consumption continues to grow in the EC and may grow more rapidly than anticipated in the MSU study. In addition, inflation could be an appreciable factor.

The USSR might find it feasible to continue to import feed grains or possibly supplements to improve feeding efficiency, particularly if favorable trade terms are offered. The recent USSR agreement to buy \$750 million worth of grain over a three-year period is an example. In fact, because of bad weather in Russia, there is some evidence that U. S. grain and soybean sales could reach \$1 billion this year alone. If such conditions continue, they could have an important impact on the 1980 export level. Even if the developed import markets expand slowly, it is likely that developing nations will make a substantial effort to build up livestock economies. This could impact heavily on developed nations with a growing surplus of grain. Of course, this would require special concessional programs that could be called "feed for development" programs to replace "food for development" programs. In such a setting, even with no basic changes in national agricultural policies (non-tariff barriers), U. S. farm

exports would easily exceed \$2 billion and could reach \$10 billion before 1980 if all these factors were favorable.

Expanded growth in exports

We might expect a new set of export conditions if negotiations to reduce non-tariff barriers were successful. With the lowering of these barriers, we can see that exports of commodities in which we have a competitive advantage would rise significantly. But, we are also aware that gains in exports would be partially offset by added imports of commodities in which we have less competitive advantage. In addition, our exports of some commodities would fall. Moreover, while there is little question that the total U. S. community would gain from totally free trade, we are unsure of the extent to which each segment of the agricultural sector will share in these benefits.

First, take a look at a commodity group in which we have a competitive advantage—the grain-livestock sector. Our preliminary analyses indicate that substantial gains in U. S. feed grain exports could be expected. This would result from increased demand for meat and livestock products because of lower prices in developed importing countries and from a reduction in feed grain production in Western Europe from levels that would have prevailed under current high grain prices. The increased world demand for meat would tend to reduce the pressure of beef imports into the United States. However, although the United States might find it profitable to export some fed beef, it would essentially still remain a net importer of grass-fed beef. Preliminary research indicates that we could realize gains up to \$4 billion in exports of feed grains and soybeans.

But trade is a two-way street. Opening the export market for feed grains might be possible only if we were to open our market for beef and dairy products. This could result in an increased import cost that could be as high as a billion dollars coming mostly from larger dairy product imports, thus reducing the net gain in export earnings. However, this net cost might be lowered by some gains in export earnings from beef for the reasons indicated above.

Generally speaking for the livestock-feed complex, removal of non-tariff barriers would tend to raise prices for beef, dairy products, and feeds in exporting countries and lower prices to consumers in importing countries. The United States, because of its technical know-how and ability to

adjust production upward because of reserve acres, would gain more than other nations during the five- or ten-year transition period to free trade. The livestock commodity group would also tend to gain from increased income induced through free trade. In the longer run we should expect to lose some of the technology advantage to developing areas, thus mitigating some of our gains.

But we cannot very well limit negotiations to only those areas in which we stand to gain the most. Negotiations may result in similar non-tariff removals from commodities for which we may even lose benefits in a free trade situation. Fruit and vegetable imports, for example, might increase substantially. What about sugar, tobacco, cotton, and textiles? We need to expand our research interest and action to evaluate the impact of negotiations on such commodities.

Finally, we need to translate the trade gains and losses commodity by commodity into farm income, program costs, and costs to the U. S. consumer. Only by looking at the total picture can net benefits be evaluated.

While the U. S. agricultural sector might gain in some commodities in the long run in a completely borderless world economy, problems of agricultural adjustment associated with economic growth will still be with us. This is contrary to the implied belief that eliminating non-tariff barriers would eliminate these problems. The nature of demand for agricultural products and the adjustments needed because of varying growth rates in production and demand would still continue but at a world level. If the United States, even with all the advantages of free trade within its border, has not been able to solve these problems, should we expect the "one" world to do so on a larger scale?

Export promotion

This paper has been addressed to only one side of the export picture, the world agricultural trade environment. The other side is the importance of export markets to the U. S. agricultural economy and our determination to keep them expanding. The commitment of \$1.0 billion to export assistance and promotion programs is evidence that the U. S. will not be satisfied with anything less than the expanded growth course.

Summary

I do not subscribe to the various theories that, when amalgamated, give a set of conditions

which limit us to our current \$8 billion level of exports. Under favorable conditions, I think we can reasonably expect to reach the \$10 billion level by or before 1980. I have implied that even higher levels would be reached through negotiation. But, if the negotiation process is to be successful, we agricultural economists will have to provide negotiators with valid analyses so that they can determine realistically the impact of their work on the U. S. economy in general and the agricultural economy in particular.

We recently asked Congress to fund this type of analysis but received only half of the amount we felt necessary to start such a research program. As we noted before, there is increasing recognition of the need to modify national sup-

port policies to make them more consistent with world trade liberalization. A principal objective of our proposed research is to identify those policies and practices most incompatible with freer trade and thus provide guidance to U. S. negotiators in establishing priorities.

The need for such research aimed at expanding our agricultural exports is clear as strong international competition for our farm exports develops. A stagnating or declining level of farm exports would require major adjustments in our agriculture, loss of farm income, and, under present farm programs, would result in higher government costs. It is a firm policy of the U. S. Department of Agriculture that this will not happen.

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Discussion: WILLIAM R. PEARCE, Deputy Special Representative for Trade Negotiations

In February the United States entered into joint declarations with the European Community and Japan committing us to broad, multilateral trade negotiations beginning next year. The West paper discusses several of the considerations that prompted this initiative, especially in respect to agriculture. The Seevers paper notes several of the problems we face in preparing for these negotiations.

One of the most serious problems involves congressional authority. The President's authority to negotiate and proclaim tariff reductions under the Trade Expansion Act of 1962 expired more than five years ago. As Seevers notes, the climate for trade legislation has deteriorated. In his view,

in the absence of mutual security concerns which influenced earlier congressional attitudes, Congress is unlikely to act unless present high levels of unemployment drop and the current trade deficit is reversed.

Seevers overstates, I think, the importance of mutual security considerations in securing authority for a new round of negotiations. No doubt these concerns were a major factor in the congressional grant of authority in 1945 for negotiations needed to lay the foundations for the GATT-IMF systems. However, in seeking authority for the Dillon Round in 1958 and for the Kennedy Round in 1962, the need for negotiations to lessen the discriminatory effect of the

European Community's common external tariff was stressed.

This seems important. While it is true that concerns about mutual security have diminished, if anything, concerns about preferential trading have grown. We now confront a community of 10, linked by preferential trade agreements to more than 50 other nations in Europe and Africa. Still more will be added when the Commonwealth developing countries become eligible for associate status in 1975.

I agree that the willingness of the Congress to give us authority to deal with these problems will be influenced by changes in the trade account and by levels of unemployment, but I see these issues in a different light.

To begin with, trade and employment are not as closely related as many people believe. Krause and Mathieson [1], for example, have pointed out that while the trade balance was declining from \$6.8 billion in 1964 to \$0.7 billion in 1969, unemployment also declined from 5.2 percent to 3.5 percent.

Labor's attitude toward trade has changed, but the evidence suggests that rising levels of unemployment had little to do with it. Portions of the labor movement were expressing protectionist views as early as 1962. The drift in this direction accelerated gradually and then emerged strongly with the lapse of negotiating authority in 1967. Labor had moved to a basically protectionist position by the time unemployment had reached its post-Korean War low of 3.5 percent in 1969.

More likely, labor's changing attitude reflects concern about other developments they see as linked to expanding trade. These include, among other things, the continuing shift of workers from manufacturing industries in which labor traditionally has been strong to service industries where labor has had less influence. Also involved are increasing problems of adjustment to changing patterns of trade—many of them stemming from labor contracts and labor practices.

Lower levels of unemployment would improve the general climate for trade legislation, but it will not eliminate labor's opposition.

In this light the positive role farm interests have played in respect to trade legislation is more important than ever before. They were decisive in defeating the Mills Bill in 1970 and in side-tracking Hartke-Burke in the present Congress.

Virtually all farm groups support expanded exports, but they differ on how this is best accomplished. Fundamentally different positions on ratification of the International Grains Arrangement at the close of the Kennedy Round revealed a basic conflict which continues to influence attitudes toward trade policies and trade initiatives. Beyond this, no major farm group has yet conceded the necessity for offering a new negotiation to reduce import restraints protecting our own less competitive farm sectors. It is not clear how these issues will affect farm support for trade legislation.

Seevers concludes, correctly I think, that our trade balance must improve before the Congress will be prepared to authorize negotiations. If the trends he described continue, the trade balance will improve.

A more important point—which Seevers also makes—is that opposition to trade liberalization stems more from the problems of industries hardest hit by import competition than from external balance in the trade account. Even when the trade account returns to surplus, imports will continue to rise, and trade patterns will continue to change and to exert pressures on firms and workers at the competitive margin of their industries.

This brings me to my final point. As Seevers notes, trade liberalization has important distributive effects. Some workers profit, while others find their problems compounded. Congress sought to even the load by including in the Trade Expansion Act of 1962 a Trade Adjustment Assistance Program. For a lot of reasons, the program has not achieved its goals. Efforts are being made within the Administration and in the Congress to improve its effectiveness. The Williams Commission suggested that more will be required and proposed the adoption of broad labor and industrial policies to improve U. S. competitiveness and the quality and mobility of the U. S. labor force. Little attention has been given to the usefulness of these programs in assisting the adjustment of farmers in less competitive sectors, perhaps because there has been little open discussion of the changes likely to occur in our domestic farm and import policies as a result of a major attack of agricultural trade barriers generally. This is worth serious consideration.

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Discussion: TED RICE AND VERNON McMINIMY, Continental Grain Company

Both West and Seevers have presented excellent papers. Each has avoided the error of proposing simplistic answers to a complex issue. Each points out that while an expanding world trade in agricultural products based on negotiations and trade liberalization is likely to favor the U. S. grain and oilseed sectors, it may have a perverse effect on other U. S. sectors such as dairy, beef, and vegetables.

Seevers' paper provides an excellent shopping list of information needed by politicians and trade negotiators. This shopping list is appropriate for a staff of economists who would support the negotiators. It is not an adequate outline for research by ERS. ERS's major efforts must be more basic and pointed even beyond the next round of negotiations whether they involve tariff or non-tariff barriers to trade.

West provides us with an excellent summary of trends in agricultural exports. He also lists some of the highlights of research in the area of foreign trade. We fully agree with his conclusion that "under favorable conditions I think we can reasonably expect to reach the \$10 billion level by 1980. I have implied that even higher levels could be reached through negotiations." We also fully agree that "if the negotiation process is to be successful, we agricultural economists will have to provide negotiators valid analyses so they can determine realistically the impact of their work on the U. S. economy in general and the agricultural economy in particular."

ERS has the organization, time, and, probably, the resources to address itself to the broader, more long-term, and fundamental picture. We need to be in a position as soon as possible to see as far as possible into the future. Dr. West's discussion of the 1980 and 1985 projections are a step in the right direction, but they are only a first step. We hope ERS will take advantage of the opportunities presented by the projection work done to date and extend and expand it. We would like to see ERS begin by critically examining their assumptions: altering, adjusting, and modifying them to see what impact they have on the product mix of U. S. agricultural exports. Dr. Seevers' paper may suggest some adjustments in assumptions.

Recently we have witnessed a dramatic alteration in assumptions: Russia entering the U. S. market to purchase huge quantities of wheat, feed grains, and soybeans. In the realm of demand for meat products and its derivative de-

mand for feed grain and protein supplement inputs, Russia has been a sleeping giant. In the past decade we have seen the giant stir and this year arise with a sudden jerk.

We have known for a long time that Russia, like many other countries of the world, is not blessed with the soil and climatic conditions which make the U. S. not only a bountiful but also highly reliable producer of cereals and oilseeds. What does the emergence of Russia into the world grain markets mean to the U. S.? What quantities of wheat, feed grains, soybeans, and soybean products will she take in the future? What does this imply with reference to U. S. wheat, feed grain, and oilseed policies? Some of these questions need answers immediately; some can wait. But in all cases the sooner we have the answers the better.

If there is any basic disagreement with the two papers, it is with the implication that export prospects depend primarily upon international negotiations. Admittedly, negotiations to open up new avenues of trade are important. The recent agreement with Russia is a good example. We need to use the bindings of old negotiations to defend existing rights, e.g., duty-free entry of soybeans and soybean meal into the EEC. But we at Continental Grain Company believe there is a tendency to underestimate the ability of the U. S. to take unilateral actions to expand trade.

The most important single factor to promote a growth in world trade of any product is to have a consistently dependable supply at competitive world prices. In the past the U. S. has generally met this test with respect to cereal grains. But this has been due more to the accident of having accumulated surpluses under price support activities than to a deliberate design to achieve adequate and dependable supplies. Currently we have inadequate supplies of soybeans to accommodate a growth in world demand. This can be directly attributable to inconsistencies in our government supply-management policies. The recently announced 1973 wheat program appears to be inconsistent with 1973-74 needs which include a need to replenish reserves.

We believe new emphasis should be placed on designing new domestic agricultural programs and policies which can best insure we will have consistently dependable supplies at competitive world prices of those products for which we have a comparative advantage.

As much attention must be paid to assuring

that reserves will be made available to the free market when needed as to: (1) how large the reserves should be and (2) how to prevent the reserves from having an excessive price depressing effect. We do not pretend to have a simple solution to this complex problem. We do feel that agencies within USDA, such as CCC and EMS, have adequate tools and experience to deal with the issues.

Time does not permit commenting in detail on other issues. Obviously we view the possibility of eventual trade with China as having considerable potential. We would like to emphasize a need to find ways to avoid our periodic disruptive shipping strikes.

In conclusion, Drs. West and Seevers have presented excellent papers. Dr. Seevers makes the point that we are entering a new era. We agree. Further, we believe we will never return to what was.

We economists are the headlights of the foreign trade vehicle of today. Our responsibility is to inform the drivers (as well as the passengers) as much as we can regarding what lies ahead. If a curve lies ahead, it is our responsibility to inform those in control as much as we can determine about the nature and impact of that curve. If we do not do our job accurately enough and soon enough, then those in that vehicle have every right to discard us.

Discussion: WALLACE BARR, Ohio State University

This discussion will be aimed at stimulating additional thought and analysis, particularly concerning the European Economic Community (EEC). To do so, I shall (1) point out some of the major areas of apparent concurrence between the two papers, (2) present information related to the European Economic Community, and (3) identify additional concerns.

The authors, not unexpectedly, appear to concur implicitly or explicitly on numerous considerations in the foreign trade policy area. These major areas of general agreement are:

- That our foreign trade policy goal should be freer trade rather than protectionism,
- That non-tariff barriers are an immediate trade policy concern,
- That negotiation of integrated trade rules are of high priority, and
- That present trends may be leading the world towards discriminatory economic blocs.

The EEC and U. S. Trade

In merchandise trade the U. S. exports more to and imports more from Canada than any other nation. Japan, although the largest single customer for U. S. agricultural products, is a distant second in the total value of industrial-agricultural products traded with the U. S. The six EEC countries have been the most important bloc of nations with which the U. S. trades. However, total trade between the present six EEC countries and the U. S. trails Canada but exceeds Japan. The future ten EEC countries, however, will exceed Canada in total merchandise trade. The recent USSR grain sale indicates that the Eastern

bloc may become a very important long-term market for agricultural and industrial products. Recent Presidential overtures to Russia and China also emphasize the potential.

Our total exports of agricultural and industrial products to the six EEC countries more than doubled (in current dollars) from \$4.0 billion in 1960 to \$8.4 billion in 1970 [5]. The share of total U. S. exports sent to the EEC in the 10-year period remained relatively stable ranging from 17 to 20 percent. U. S. merchandise imports from the EEC grew nearly three times in the decade but remained a remarkably stable 15 to 18 percent of total U. S. imports (\$2,263 million in 1960 to \$6,612 million in 1970). The 10 nations making up the EEC as of January 1, 1973, took 27 percent of all U. S. exports in 1970 and supplied 24 percent of all U. S. imports.

U. S. farm products exported to the present six EEC nations varied from \$1.2 to \$1.6 billion from 1963 to 1970, then expanded to \$1.8 billion in 1971 [4]. The record U. S. farm exports to the EEC countries in 1971 reflect the reduced 1970 cereal crop in Europe and higher feed grain prices due to corn leaf blight. Even with variation in the value of shipments to the six EEC countries by the U. S., the EEC imported 21 to 24 percent of the total U. S. farm exports in the 1963-1971 period. Combining the agricultural exports of the present six EEC countries with the four new entrants shows that in the last two years 29 to 32 percent or more than \$2.2 billion each year of total U. S. agricultural exports went to these important farm product markets.

There have been, however, striking changes in

the composition of U. S. agricultural exports to the six EEC countries. Since the implementation in the mid-1960's of the EEC common agricultural policy (CAP), the value of U. S. wheat and feed grain exports has trended downward [3]. The declines reflect the implementation of the non-tariff barriers of relatively high support levels which encourage EEC production and the variable levy which protects the EEC market.

Some changes in the composition of U. S. farm exports are well known. During the last decade the value of U. S. soybeans exported to the EEC increased threefold reflecting both volume and price changes [3]. U. S. exports of soybean meal to the EEC increased fivefold. Much less known is the more than tenfold increase (to \$62 million) of U. S. exports to the EEC of feed items such as bran, dried and pelleted hay, food waste products, and prepared animal feeds [2]. These changes reflect increasing EEC livestock numbers, growth in feed compounding, improvement in the protein level of rations, and search for substitutes for the higher priced cereals.

The relatively high EEC cereal price supports, the import protection against foreign produced cereals that is provided by the variable levy, and the export subsidies have encouraged intensification of EEC grain production. The production of all grains, excluding rice, reached 74,657,000 tons in 1971 or 44 percent above the 1960 level [1]. All of the increase came from higher yields as 49 to 52 million acres were devoted to cereal crops each year from 1960 through 1971. There have been shifts within the cereals. Corn, barley, and durum wheat acreages each have increased about one-third. Rye, oats, and soft wheat acreages have declined.

The EEC cereal grain deficit declined steadily from the mid-1960's, when CAP was fully implemented, through 1970. EEC imports of grains from all sources in excess of exports amounted to 12 million metric tons in 1966-67 but decreased to 2.6 million tons in 1969-70 [1]. With the poor crop year in 1970, grain imports in excess of exports increased to 14 million tons during 1970-71.

U. S. wheat has faced increasing amounts of heavily subsidized EEC wheat exports in world markets with the exception of 1970-71. Wheat has accounted for 50 to 60 percent of all EEC grain exports each year since 1966 [1]. The five-year average is near 5.1 million tons exported to non-member countries or near 190,000 bushels per year. This has the effect of increasing

competition with the U. S. and other wheat suppliers in world wheat markets.

Feed Grain Substitutes

The feed industry and livestock feeders in the EEC minimize cereal use by substituting ingredients with lower energy costs. Included are such items as manioc, bran, food wastes, and dried pelleted beet and citrus pulp. The use of these cereal substitutes generally lowers protein levels and requires increased feeding of oilseed cakes and meals. The price difference between cereals and protein meal in the EEC is much less than in the U. S. due to the relatively high grain price. The use of lower cost cereal substitutes in the EEC benefits the U. S. soybean industry which is the most dependable supplier of large quantities of low-cost protein.

The rapid increase in EEC imports of levy-free dried and pelleted manioc from Thailand and Indonesia, priced near \$70 per metric ton at Rotterdam, will be used to illustrate the current shift from cereals to cereal substitutes. The increased use of manioc in West Germany, Netherlands, and Belgium is due in part to its lower price relative to barley, wheat, or corn and in part to the cost of transportation and difference in price support levels among regions of the EEC. France has the lowest support prices for cereals and high costs for transportation to its interior agricultural region. The economics are such that the French feed grains—not substitutes—to livestock. Germany, Netherlands, and Belgium have lower cost water transportation and higher cereal support prices. Thus, their farmers sell grains to the price support agency and purchase mixed feeds containing lower priced cereal substitutes. It becomes readily evident that price supports are an important factor in the rapid expansion in use of cereal substitutes like manioc from Thailand and Indonesia.

EEC Agricultural Support Prices

Price support levels to producers or the intervention price, and the threshold price or level for calculation of the variable levy for cereals and livestock, were raised 3 to 5 and 5 to 7 percent, respectively, this year. Similar increases are scheduled next year. These raises are naturally favored by European producers. Some other interests like businessmen, government officials, consumers, and some agricultural leaders recognize the limitations of future support price in-

creases. There is growing recognition that farm price policies will not solve farm income problems and that farm structural changes will be required. Also, because of sizable financial commitments the finance ministers of the EEC countries are taking a more active part in the CAP decisions which were formerly left to the agricultural ministers.

Butter is the EEC farm commodity that may reach surplus proportions first. Anticipation of improved milk prices is leading to retention of large numbers of heifers and future expansion in dairy cow numbers in the new entrants, Ireland and Denmark. Beef prices are high in the present EEC countries with a very strong demand for feeder calves. Additional feeder calf production must come from the dairy-beef breeds and probably means additional milk production in the present EEC countries. Policy actions to alleviate the butter problem may include a suckling calf policy. But it is doubtful that this action or implementation of the previously used cow slaughter policy will be effective in avoiding the surplus problem.

The political, economic, and social climate in the EEC is such that reductions in support prices, other than perhaps dairy, are not likely in the near future. The EEC exceeds self-sufficiency in wheat. In total cereals they have approached, but never fully attained, self-sufficiency. Steady to slightly higher cereal grain support prices seem probable in the future. In such a situation, inflation rates may far exceed the increased support prices and result in cost-price squeeze for EEC farmers.

Bloc Formation

Both Seevers and West made reference to the formation of economic blocs and their tendency to develop discriminatory practices that restrict trade. The EEC is an illustration. Another device being discussed by the EEC is the international commodity agreement. Attention centers on those products not produced extensively in the EEC that are or might be produced in developing

countries. Some would directly affect U. S. products; some would have indirect impacts. U. S. experience with commodity agreements generally has not been favorable. Still, are there cases in which a commodity agreement may be useful in protecting U. S. markets? Little interest is exhibited in the EEC for a commodity agreement for EEC-grown farm products.

Less well known are present efforts by the EEC to extend preferential arrangements to many non-member nations. Preferential arrangements extend privileges by systematically granting market concessions to some non-member nations while systematically discriminating against other non-member countries. The expanded EEC (to 10 members as of January 1, 1973) and the remaining former European Free Trade Association countries are nearing agreement on preferential trade arrangements. In addition, the expanding EEC is considering extending preferential arrangements to additional Mediterranean countries, numerous developing African nations, and some others. Sixty or more nations may be involved with some type of preferential arrangement with the 10 EEC countries.

If one considers the USSR-led Eastern bloc of nations and the EEC bloc, an impressive number of nations are within some trade group. Who is left? Japan, U. S., Canada, and Australia of the major developed nations plus China and many developing countries remain. Is the course of world events leading to bloc formation? Seevers did suggest that neo-isolationism could lead to a Japanese-led Asian bloc and a North American bloc. He recognized the problems facing the developing nations in aligning with one bloc or another. Where does China fit? Will the trend towards expanding bloc formation be reversed? Is GATT dead or alive? In a world of trade blocs can multilateral monetary and SALT-type trade negotiations succeed or prevail? What U. S. policies, programs, and strategies will be necessary if we move to bloc formation? In a world of blocs, which countries are most compatible with U. S. agriculture or could be with some adjustment?

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Discussion: ROBERT C. TETRO, FAO, UN

Both of our main speakers are to be complimented for workmanlike approaches to a complex problem. Their papers are hard to criticize and I do not believe criticism is the purpose of our session today.

Obviously, there is always some possibility of nit-picking. For example, in Gary Seevers' reference to the Smithsonian Agreement (a term that in itself is loaded with grey stones, red brick, and ivy all over the place) we hear of a large group of countries collaborating to establish exchange rates. Another version might be that a *small* group of *large* countries once again tried a barnyard halter of rigid rates on the stallion of world capital markets. Also, both West and Seevers mention a possible market under free trade for American "fed beef." This, to the literally and figuratively hungry developing world, sounds like the royal decree that "they should eat cake" and, at best, would seem a highly sophisticated stratification of demand aimed to exploit an occasional American or Americanized presence in Paris, Rome, London, or Tokyo.

What's Good for the United States?

More seriously, I would like to deal with two general reactions and some associated specifics. First, to a large extent each paper has a unilateral perspective of "what's good for the United States?" My concern in this regard lies in the resultant prophecy that during the next GATT negotiations there will be "no room at the inn" for the Third World and particularly for the least developed part of that world. This is rather specifically stated by Dr. Seevers as, "Developing nations would face the difficult choice of aligning with one of the blocs dominated by industrial countries, or remaining on the outside." A paraphrase of that thought says they may revert to colonial status or remain economically isolated.

Such casuistry as this tends to condemn the nearly 3 billion of the world's poor to continued hopeless poverty. That part of the world has no chance whatsoever to achieve a level of living now taken for granted in the United States and most other OECD countries. A recent issue of *Time* [2] put this in perspective in discussing India after its first quarter century of independence, quoting government figures that half of India's 550 million people continue to live on less than \$2.76 a month. It further quoted India's

finance minister as saying that "80 percent of the downtrodden have remained virtually untouched by the development process and it would be perilous to ignore them." Such ignoring might well follow from our failure to consider adequately the trade problems of developing countries during our next GATT round.

In 1969 agricultural exports provided more than 80 percent of total exports in 26 developing countries and more than 50 percent in another 24. By comparison, agricultural exports accounted for only 19 percent in France, 17 percent in the U. S., 11 percent in Canada, and only 4 percent in Japan. The only two developed countries where the proportion was higher than 50 percent were New Zealand with 85 percent and Australia with 59 percent—and Australia's percentage is declining rapidly [6]. Despite the paramount need for increased earnings from agricultural exports in developing countries, their share of world agricultural trade fell from 46 percent in 1955 to 34 percent in 1969. Over the same period, world agricultural exports increased by 70 percent from \$27.6 billion to \$45.8 billion [6].

My Director-General, Dr. A. H. Boerma, addressing UNCTAD III last spring, reviewed these developments and pointed to the prospect that agricultural exports might increase by another third in this decade and suggested that the UNCTAD Conference should seriously concern itself with how to ensure "that the developing countries have an equitable share in this increase in world trade" [1]. One should point out that the suggestion is to share in an *increase* and not in any way reduce gains already made by agricultural exporting nations. Parenthetically, that was the minimum UNCTAD III goal for the commodity position of the "77" at Lima. At the same conference, Mr. McNamara of the World Bank, addressing himself to the same problem of export earnings, pointed out that an infinitesimal share of the *prospective increase* in the gross national product of developed countries could easily meet the maximum aid needs of the developing countries [4].

Whatever may be the eventual vehicles for achieving some minimum redressing of the disadvantaged agriculture of the developing world (i.e., international commodity arrangements, shared markets, or some policy forum for an as yet undefined global approach to world agricul-

tural adjustment), the need for more understanding of the underlying facts is great. FAO gave us one look at this in its projected 1980 not balance but imbalance of possible supplies of and demand for major groups of commodities (Table 1). Eric Ojala in his Stanford address on the cereals part of this problem closed by saying, "The location of the adjustments that inevitably take

place, as between developing and developed country exporters, and therefore the impact on the structure of trade, will be determined as much by the balance of political forces as of economic ones. A much more broadly acceptable international framework for such adjustments, of which there is no sign at present, will have to be formulated and negotiated, if the benefits of agri-

Table 1. Projected world commodity balances, 1980 [6]

	Production ^a	Demand ^a	Balance		Export avail-abilities ^a	Import require-ments ^a
			Excl.	Incl.		
			Asian centrally pl. economies			
(..... Million tons)						
Cereals	1,292.3	1,224.1	+68.2	+62.9	162.5	94.3
Wheat	354.6	330.1	+24.5	+18.0	55.6	31.1
Rice	255.5	253.0	+ 2.5	+ 3.8	11.7	9.2
Coarse grains	682.2	641.0	+41.2	+41.1	95.2	54.0
Sugar, centrifugal (raw basis)	88.1	88.5	- 0.4	- 0.7	21.8	22.2
Citrus fruit	48.2	47.5	+ 0.7	+ 0.8	9.5	8.8
Oranges and tangerines	39.6	39.2	+ 0.4	+ 0.5	7.1	6.7
Lemons and limes	4.5	4.5	—	—	1.3	1.3
Other citrus	4.1	3.8	+ 0.3	+ 0.3	1.1	0.8
Meat	110.7	112.6	- 1.9	- 2.2	7.0	8.9
Beef and veal	48.8	50.0	- 1.2	- 1.7	3.8	5.0
Mutton and lamb	8.4	9.0	- 0.6	- 0.6	1.0	1.6
Pigmeat	33.0	33.1	- 0.1	+ 0.1	1.5	1.6
Poultry meat	20.5	20.5	—	—	0.7	0.7
Fish (incl. shell fish)	73.2	80.9	- 7.7	- 7.8	22.8	30.5
Milk, whole liquid	472.0	492.0	-20.0	-20.5	23.3	43.3
Fats and oils (incl. butter)	50.8	49.1	+ 1.7	+ 1.2	13.6	11.9
Oilcakes & fishmeal	67.3	64.4	+ 2.9	+ 3.4	29.0	26.1
Tobacco	5.1	5.1	—	—	0.8	0.8
Wine	35.9	37.1	- 1.2	- 1.2	3.4	4.6
Coffee	5.7	5.7	—	—	4.1	4.1
Cocoa	1.8	1.8	—	—	1.6	1.6
Tea	1.6	1.5	+ 0.1	+ 0.1	0.9	0.8
Cotton—Basic projection	11.8	11.2	+ 0.6	+ 0.7	3.9	3.3
—Suppl. projection	10.8	9.7	+ 1.1	+ 1.3	3.9	2.8
Wool—Basic projection	1.9	1.8	+ 0.1	+ 0.1	1.0	0.9
—Suppl. projection	1.8	1.6	+ 0.2	+ 0.2	1.0	0.8
Jute—High alternative	4.3	3.3	+ 1.0	+ 0.8	2.8	1.8
—Low alternative	3.4	2.0	+ 1.4	+ 1.4	2.3	0.9
Hard fibers	0.9	0.9	—	—	0.6	0.6
Rubber—Basic projection	4.8	4.2	+ 0.6	+ 0.1	4.1	3.5
—Suppl. projection	4.8	3.4	+ 1.4	+ 1.0	4.3	2.9
Industrial roundwood ^b	1,471	1,465	+ 6.9	+ 4.9	72.8	65.9
Sawnwood ^b	457	456	+ 0.7	n.a.	22.9	22.2
Panels ^b	113	113	+ 0.3	n.a.	6.9	6.6
Pulp	n.a.	n.a.	+ 1.6	+ 1.2	9.4	7.8
Paper	217	221	- 3.9	- 3.9	6.3	10.2

^a Excluding Asian centrally planned economies.

^b Million cubic meters.

cultural science and technology are to be widely and equitably shared among the peoples of the world" [5].

Immutable Agriculture

A second general reaction was mitigated to some extent by Dr. West and lies in the danger of considering agriculture as immutable, monolithic, and (in spite of agribusiness) almost anti-industrial. It would seem to me that the wide-open barn door in our discussions of commodity trade lies in our ignorance of what is going to happen with individual commodities—commodities whose production and marketing structures vary so widely on a global basis. Quentin [West] approaches his conclusion with a rhetorical sentence, "What about sugar, tobacco, cotton and textiles?" The question raised refers to commodities supposedly carefully studied for decades, if not centuries, and yet they continue to surprise us with unexpected and drastic shifts in world markets. He might have added rice! We can only agree with him on the need for expanded research and urge that it be on a global basis. We do seem to have learned that economic and social costs cannot be aggregated and that any adjustment studies on a global basis must have compensating losses and gains among the countless regions and countries involved. We can only hope these will be honestly stated and openly negotiated.

As we approach the new look at commodity trade in the 70's, the global perspective would perhaps question the eagerness of the U. S. to negotiate things such as access and non-tariff restrictions. An equal concern is not yet obvious within the European Community where expansion tends to create an agriculture that never had it so good; nor in Japan which is becoming the epitome of a processing industry somewhat comparable to petroleum refineries; nor, to shorten an obvious list, in Canada with its rapidly maturing agricultural economy demonstrating a growing confidence in future prospects, dampened only by its occasionally dominating south-

ern neighbor. To oversimplify, our agricultural competitors are not as anxious as the U. S. to negotiate in the agricultural field, and many of them may be still smarting from that 10 percent surtax which was the bitter pill in last year's NEP package.

Jobs and Trade

While difficult timewise to develop here, I am indebted to Gary [SeEVERS] for a provocative page on jobs and trade. He states flatly that "representatives of organized labor no longer support a liberal trade policy." In some ways that is the major euphemism of our papers. Certain parts of organized labor have never supported a liberal trade policy, and there probably is no one in this room with a living memory of anything like unanimity in the U. S. for liberal world trade. I am sure you see the thread of this argument. In a way I am inclined to compare the protagonist of "we have got the comparative advantage," both industrially and agriculturally, with the isolationists of the 30's whose figuratively flexed muscle was based on the almost primitive, and by then non-existent, skill of the squirrel-shooting pioneer.

The employment problem is critical—domestically and globally—and has been worked over by many economists. One of the best statements I have read recently was Sir Arthur Lewis's four steps for employment as reported in the house organ of the Society for International Development [3]. I was particularly struck by his paragraph on the inevitability of something like "incomes policies." Also of interest in this respect has been the battle of the London *Economist* to present the case against labor in the hiatus in the U. K. I am sure something comparable has been done in the U. S., but I haven't seen it lately.

To summarize, our major papers are excellent and provocative; nevertheless, from a global perspective the problems of the developing world are far more serious and the results of our failure to resolve them are potentially more tragic than those major papers indicated.

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General Session

EDUCATION AND DEVELOPMENT

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The Increasing Economic Value of Human Time

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WHEN data and theory talk to each other there is hope for economics. We are very much in need of such talk with a view of explaining the long-term changes in relative prices of the productive services of the factors of production. When we leave the equilibrium static state and endeavor to bring theory to bear on the economic processes that change these prices relative one to another, our factor price economics is wanting. Modern economic growth theory puts this issue aside on the convenient assumption that these prices do not change relative to each other. The classical economists, however, had more courage and a broader perspective of economic processes, and their theories continue to influence our thinking about long-term changes in rents relative to wages and relative to the price of the services of reproducible capital. By their theory, rents would necessarily rise relative to wages. But the data have been hard on this theory.

We were all taught that the rent paid for the services of land must rise relative to the price of other factor services in accordance with the rise in Ricardian Rent as a consequence of population increases and of economic growth because of the highly inelastic supply of land. But what we observe in countries where per capita incomes are high is that rent per acre declines over time relative to the price of human time. In the United States, for example, the total real compensation per hour at work of all manufacturing production workers increased between 1929 and 1970 more than four times as much as did the rent of farm real estate per acre similarly adjusted.¹

¹The compensation per hour of work includes fringe benefits which have been increasing relative to wages. These estimates are from the studies of Albert Rees as reported in [6, pp. 183-189]. I have extended this series to 1970. The farm real estate prices are from [46, Table 1]. I assume that rents have tended to parallel the changes in prices per acre. I should also note that investments in

In explaining long-term changes in the size of the labor force and in wages, if we follow the first edition of Malthus' *Essay on Population*, the price of children remains constant over time and the supply of laborers is highly elastic. The wage implications are obvious. But we know that the economics of human fertility is not as simplistic as Malthus envisioned it. Nevertheless, we have not developed an alternative theory of population growth. As I have noted elsewhere [41], the Malthusian assumption about bearing and rearing children in response to economic growth led, of course, to the long-standing dismal economic perspective with respect to the population consequences of the accumulation of capital and of any advances in the techniques of production. While economists no longer accept the subsistence standard of living as invariant over time in view of the widely observed rise in standards of living that has occurred, we leave it to biologists, to sociologists, and to demographers to explain increases in the size of the population. But they, like us, have no theory of population growth, except for a few biologists who feature the population bomb doomsday implications which rest basically on the early Malthusian notions of reproductive behavior.

Contrary to the dismal economic perspective of classical thinking with rents rising and wages constant, the approach to the price of human time to be presented here implies a fairly optimistic perspective of economic processes. Admittedly it is a long-term view of changes in relative factor prices.

With respect to the price of capital, despite the continuing controversy about underlying fundamentals, the core of economic theory implies a tendency toward a constant long-term real interest rate, and this implication is broadly consistent with the data. There are, however, two ma-

farm real estate improvements were substantial during this period; accordingly, the rise in price of farm real estate reflects the value of these improvements, in addition to any rise in Ricardian Rent.

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jor unsettled issues that plague capital theory, namely: (1) how do we treat the heterogeneity of capital and (2) in view of the vast increases in the stock of capital in the advanced economies, why are diminishing returns to capital not evident as would be expected on theoretical grounds? On the latter point, the data are saying there is something missing in the theory.

The central problem to which I now turn can be stated briefly. Although the price of human time is the most important cost component in modern production and although this price has been rising secularly relative to land rent and to real interest rates and markedly so, we have no satisfactory economic theory to explain this persistent and potent rise in the price of human time and to guide us in analyzing its economic implications. I shall first present an economic approach to this problem and then consider some of the more important implications.

An Economic Approach

What determines the long-term changes in the supply of and the demand for the services of human agents? Recent advances in economics provide parts of the theory for determining the changes in the supply of the *quality attributes* of human agents. The useful abilities that people acquire are viewed as forms of human capital. The investment in these abilities is taken to be in response to favorable investment opportunities, and thus the increases in the supply depend on current expenditures (sacrifices) made by individuals, by families, and by public bodies on education, on health, on on-the-job training, on the search for information, and on geographical migration to take advantage of better jobs or of better consumption opportunities. These expenditures (sacrifices) are presumably made deliberately with an eye to future personal satisfactions and earnings. During the last several years economic analysis has been further extended to cope with fertility behavior to determine the number and quality of children that parents bear and rear [43]. Accordingly, in determining the long-term changes in the supply of the services of human agents, the fundamentals of a theory are at hand along with substantial empirical support.

It may be helpful to be more explicit on the advances in economic analysis that have made the supply part of this approach possible. The idea and the theory of investment in human capital need not be elaborated further. (See Mincer [25, 26, 27], and [2], [35], and [36] for my

early work and that of Becker in this area. The economic significance of the producer attributes of human capital have been summarized succinctly by Harry Johnson [14] as featured in [40, pp. 12-16]. A second important advance is the treatment by Becker of human time in the allocative decisions with respect to both market and non-market activities [3.] (See also Lancaster [22].) The linkage between human capital and this concept of the allocation of time is strong and clear. The usefulness of the new concept of human time is not restricted to work in the labor market, for it is also applicable to work in the household. In the household, predominantly the housewife's time is allocated in part to shopping for and choosing consumer goods and in part to using them in household production leading to consumption. Then, too, consumption per se also requires time. The central principle underlying this analysis is that in reality each consumer service has two prices attached to it, namely, a money price as in traditional theory of consumer choice and a time cost of acquiring the consumer good and processing it in the household plus the time cost that is involved in consuming the services obtained from this household activity.²

The third advance is the household production function. It was a direct outgrowth of the concepts of investment in human capital and allocation of human time. The household production function provides a comprehensive approach to non-market activities of the household, activities that were foreshadowed by the much earlier work of Margaret Reid [31]. The distinctive merit of Becker's theory of the allocation of human time is in accounting for the use of the individual's time in household production activities. The household production function is for this purpose a new, useful analytical tool.³

The fourth advance is a view of the family as a decision-making unit maximizing both its utility in consumption and in determining the allocation of human time and of purchased goods in the production activities of the household. According to this view of the family, the welfare of each member of the family is normally integrated into a unified family welfare function, and shadow (non-market) prices play an important role in the family's producer and consumer activ-

²This paragraph and the next two are drawn in part from my paper [41].

³The usefulness of this tool is suggested by its applications in analyzing the derived demand for health, leisure, durable goods, and transportation and in ascertaining the derived demand for children.

ities, including the bearing and rearing of children.

To sum up, we now have in large measure a theory of the changes in the supply of the services of human agents. It is mainly capable in determining the changes in the supply of the quality attributes of human agents, attributes that have economic value because they render either producer or consumer services. With respect to quantity, it would be premature to claim that we have, as yet, a satisfactory theory of population growth and labor force participation.

But the demand side is still in large part an unexplored frontier. The puzzle is, why does the demand for the quality attributes of human agents increase so persistently in the advanced economies? What are the factors that are functioning in these economic processes that account for the remarkable increases in this demand, notably in the United States? This growth in demand is implicit in the fact that between 1929 and 1957 the educational capital embodied in the labor force of the United States increased at an average annual rate twice as high as that of reproducible tangible wealth [39, Table 5.1.] We know the simple answer to the implied question of why the accumulation of human capital occurs at a higher rate than that of nonhuman capital. Theory implies that this difference is a response to the difference in rates of return. Empirical analysis strongly supports this implication of theory [2; 39, Ch. 10].

But this response to the difference in rates of return sheds no light whatsoever on why the rate of return to human capital tends to be relatively high. The basic question is: What is it about these economic processes that increases the demand for the services of human agents that in turn have long maintained the relatively high rate of return to human capital?

Thinking about the demand problem here under consideration, I am convinced that we must explain simultaneously two critical factual puzzles. The first fact, to which I have already alluded, is that diminishing returns to capital have not occurred generally despite the vast accumulation of capital in the advanced economies. The second fact is the relatively high rate at which the formation of human capital has occurred. Of the two, the first factual puzzle is the more fundamental. I shall contend, moreover, that the resolution of the first puzzle also provides a solution for the second.

The key to both puzzles is in the additions to

the stock of useful knowledge. The acquisition, adoption, and efficient utilization of this knowledge provides new sources of investment opportunities, maintains the growth process, and keeps the returns to capital from diminishing over time. Furthermore, these additions to the stock of knowledge are relatively more favorable in increasing the investment opportunities in the quality attributes of human agents than in the quality components of material agents of production.

I find support for this approach of the economic role of knowledge in some of the insights of both Marshall and Knight. Marshall [24] in his 1890 treatment of the agents of production—land, labor, capital, and organization—observed that “capital consists in large part of knowledge and organization,” and that “knowledge is the most powerful engine of production.” Knight in 1944 [15] in what I now consider to be one of his classic papers, “Diminishing Returns from Investment,” perceived the role of improvements in the quality of the labor force and advances in the sciences as they affect, over time, the rate of return to investment.⁴

I remain convinced that an investment approach is required in coping with the problem at hand; it must be an all-inclusive treatment of investments to determine *all of the sources* of additional income streams. The mainspring that keeps these processes going is the rate of return to investment, and the inequalities in the rates of return determine the allocation of investment resources among the various investment options. The basic assumption is that the allocation of investment resources is made in accordance with the standard set by the relative rates of return to alternative investment opportunities.⁵

Thus, in a nutshell the persistent increases in demand for the high quality services of human agents is a function of the additions to the stock of useful knowledge. The complexities of the additions to this knowledge have been much greater in recent, modern economic growth than during the early, relatively simple industrialization. The rate at which the stock of useful knowledge has increased has also been higher than the rate at which it took place during the early stages of industrialization. I concur in the historical interpretation of Mark Blaug [5] that the schooling of the labor force played a relatively small role in the early industrialization of England. But it is not presently so in the modern-

⁴ See the Preface to [39].

⁵ I elaborated on this in Chapters 2 and 3 in [39].

ization of either agriculture or industry, an issue to which I shall turn in the next section.

On Implications

This approach to long-term economic processes has broad integrative power in that it provides a unifying principle for a consistent explanation of the allocation of investment resources encompassing both human and nonhuman capital as modernization proceeds. It has many implications that can be tested against data. It implies that the value of human time increases relative to the cost of investment resources. It implies that the relative share of national income accruing to labor increases and that the personal distribution of income becomes less unequal. It implies that there is a special premium for the allocative ability of both males and females in managing firms and households and in allocating their own time, including their investments in themselves and in geographical migration. It also implies that, as the value of the time of mothers increases, fertility declines. Then, too, this approach implies that the social rate of return to expenditures on research is (has been) higher than that on most alternative investment opportunities. I shall consider briefly each of these implications in turn.

Long-term economic processes under conditions that are characterized by a tendency toward constant cost of investment resources and by a relatively high rate of return to investment in the quality attributes of human agents imply that the capital component embodied in people, per person, will increase and that the price of human time will increase relative to the time cost of capital resources. As a theoretical proposition, this summarizes an important part of the economic history of the advanced economies. The supporting evidence is compelling; both males and females in these economies have become, to an increasing extent over time, capitalists in terms of human capital as a consequence of the investment they have made and are making in education, on-the-job training, health, and in migrating geographically. The returns that accrue to them from accumulation of this human capital are in large measure the source of the increases in the economic value of human time.

A theory that is capable of explaining the long-term increases in the value of human time also implies that the relative share of national income accruing to labor will rise. I refer here to the changes in the functional distribution of income between labor and property assets. It is widely observed that the share of national in-

come accruing to labor has been increasing. Kuznets [20], taking a long view of the economic processes of Western countries, sees labor's share as having risen from 55 to 75 percent, while the share accruing to property assets was declining from 45 to 25 percent. Thus in fact the share earned by labor increases relatively as the modernization of the economy proceeds. A simplified way of putting the argument is that as growth occurs, the complementarity and substitution among factors and the rates at which the factors are augmented are such that the role of human capital increases relative to that of the other forms of capital. Krueger's study [16] is, in my judgment, most telling on this issue. In explaining the large absolute differences in per capita income between poor and rich countries in terms of factor endowments, she concludes "that the difference in human resources between the United States and the less-developed countries accounts for more of the difference in *per capita* income than all of the other factors combined" [16, p. 658]. The human resource that matters most in her study is education.

To digress, the recent estimates by Lianos [23] of labor's income share in U. S. agriculture are too low because the value of the time of farmers is assumed to be no higher than the wages paid to hired farm workers. The difference in human capital per person between these two groups is much in favor of farmers and members of their family. The omission of this difference, given the model, attributes a good deal more of the current agricultural income to land than is warranted in terms of theory and evidence.

Returning to the main theme, the accumulation of human capital has profound implications pertaining to the broad question of social and economic inequality. Although the theoretical linkage between functional and personal income is still weak in coping with changes in the economy over long periods, important advances in economic analysis are at hand. The data already noted with respect to Western countries make it evident that the share of personal income derived from property has declined, and it is well known that personal distribution of the property assets is much more unequal than the personal distribution of earnings. Under the assumption that the personal distribution of earnings has not become more unequal over time, it follows that the personal distribution of the total personal income has become less unequal.⁶

⁶ Long-term studies by Kuznets [17, 18, 19] show the personal distribution of income becoming more equal over

The fact that so large a share of personal income in our economy is derived from earnings has led to the development of a human capital approach in analyzing the personal distribution of income. The pioneer work is by Mincer [25, 26, 27]. Becker's contribution in 1967 [4] set forth a general analytical approach restricted to static economic assumptions. Mincer, meanwhile, has integrated education and on-the-job experience in bringing theory to bear on data. I have had occasion to survey these contributions along with those of Chiswick [8] and other recent studies [40, pp. 26-27]. The theory, as I have pointed out, still rests on static economic assumptions; it has not yet been extended to cope with long-term developments in the economy (see Chiswick and Mincer [9]).

The long-term increase in the demand for the quality attributes of human agents, as we have envisioned it thus far, is a demand for skills and other abilities to do the many, new (complex) tasks associated with the advances in useful knowledge. There is, however, another important attribute in the roles that males and females perform under such dynamic conditions. It is their *allocative ability*, i.e., the ability to take advantage of the opportunities that such conditions afford. This allocative ability is revealed in the *rates* at which males and females are capable of adjusting their activities, given the disequilibria implied in this approach.

One way of clarifying the source of the economic value of this allocative ability is as follows: Suppose that the investment processes throughout the economy were to arrive at a long-run equilibrium. The relevant implication of such an equilibrium may appear paradoxical in the sense that the economic value of this allocative ability would decline relative to its value prior to the state of equilibrium. Education, for example, gives better-educated people greater allocative ability to take advantage of the opportunities associated with advances in useful knowledge, as Welch has shown [47] in analyzing the rates at which U. S. farmers decode, act on, and use efficiently new technical information produced by the research sector.

It is fitting that I turn at this point to agriculture because farmers are both workers and entrepreneurs. I shall feature schooling because it is the major investment in human capital. Starting with traditional agriculture [38] and assuming that the farm and the household activities are in long-run equilibrium and that no events occur to disturb this equilibrium, economic activities under these assumptions become routine. Since there are no new techniques, farm people know from long experience the quality of the factors they employ, the productivity of the crops they grow, and the utility of what they consume. They are not involved in decoding new information with respect to either farm production or household production. What then is the economic value of schooling under these conditions? The implication is that farm people informally acquire the skills and information that are useful to them and that the economic value of formal schooling is small. Thus, there is little or no incentive to make current sacrifices to acquire schooling because the future returns from it do not warrant the sacrifice.

As the modernization of agriculture gets under way, some aspects of farm work call for new skills, but most of them—in my view—may be learned from experience as efficiently as from schooling. But the particular allocation ability of farmers, envisioned by Welch, is dependent on schooling because the ability to read and write now becomes important. Given the expectation that the process of modernization will continue, the demand for elementary schooling emerges.⁷

We are on firmer ground in economic analysis as we turn to the continuing modernization of agriculture in the advanced economies. In these economies, all manner of technical and economic developments are crowding in on farm people. The pace is such that a new input becomes "obsolete before its productivity can be fully explored." Equilibrium is neither at hand nor in sight. Both the farm firm and the farm household are in this dynamic state. In managing their farms and households, farm people are continually reaching for new things, trying them, learning about them, and deciding whether they are worthwhile. They are adjusting their household activities no less than their farming activities to changing technical and economic conditions. Farm people in some of these countries have made extraordinary

time in major Western countries. The vast inequality in wealth (property assets) is set forth by Lampman [21]. T. Paul Schultz [32, 33] has studied the separation of the secular trends from the cyclical behavior in this distribution of income. He has also examined [34] the puzzle inherent in the fact that the personal distribution of income in the United States has not continued its secular tendency toward less inequality since the late Forties.

⁷ There will be a lag on the supply side in adjusting to this demand for reasons I set forth in [37]. For a general approach to this issue, see my paper in [42].

adjustments during recent decades in trying to stay abreast of changing circumstances. The farm population has declined dramatically and the number of farms has dropped sharply. More of the same is in prospect.

The educational implications of this type of economic development, as already noted, have been investigated by Welch [46]. His findings are that in a technical, dynamic agriculture of this type the explanation of education's productivity is mainly in the difference in the *allocative abilities* associated with the difference in the level of education. The hypothesis is that more educated farm people "are more adept at critically evaluating new and reportedly improved inputs." They "can distinguish more quickly between the systematic and random elements" as they seek to take advantage of the new inputs, whether these be in farm production or in household production. Welch's empirical analysis supports this hypothesis in the domain of farm production to which he limited his test. His results show that this "allocative ability" plays a key role in determining education's productivity in agriculture and is relevant in a dynamic setting [46, p. 47].

Clearly, in the United States, as modernization continues at this rapid pace and where farm people in general have high levels of income, the economic value of education is such that the optimum level is not attained by elementary schooling. More education than this is required to satisfy the demand for education of farm people. Farm people with 12 years of schooling are winning out in competition with those who have 8 and less years of schooling. Furthermore, those with 16 years of education have been gaining relative to other levels over time.⁸

I alluded to the apparent paradox that if the modernization were not to continue and farm production and household activities were to ar-

rive at a long-run equilibrium, the value of education would decline. Although such an economic state is a theoretical possibility, it is assuredly not in sight. It is, nevertheless, a useful model in thinking about the economic value of education. Under such circumstances, the economic activities of farm people would be repetitive; year after year they would do essentially the same things except as each family made accommodations to meet its life cycle requirements. There would be no new inputs to upset this routine. The information required pertaining to farm and household production would be known. The economic value of the allocative ability associated with education would decline. The optimum level of education would become less than it is where farm people have attained a high level of productivity and modernization is continuing at a rapid pace. Relatively high-level work skills would still be needed but not the allocative ability. Farm people with 12 years of schooling would no doubt do about as well as those with more education.⁹ Even less than 12 years might suffice, that is, would become the optimum under such circumstances.

Let me digress once again. It is well known that a considerable part of the personal income of U. S. farm families is derived from nonfarm sources. This part, moreover, has been increasing markedly relative to that from farming. It is presently nearly as large as that from all farming activities. Most of this personal income of farm families from nonfarm sources consists of earnings for off-farm work. The size of these earnings is, I am convinced, determined in large part by the human capital of farmers and members of their families who engage in this off-farm work. Yet nowhere, to the best of my knowledge, has anyone seriously analyzed this important development.

Returning to the role of this allocative ability, it is strong and clear at many points in economic behavior. With more education, the rate of adjustment is higher in geographical migration whether the response be to better job or consumption opportunities. It is also evident in consumption and household activities and in the

⁸ In March 1970, 10.8 percent of the employed males in agriculture had one or more years of college (7.6 percent, 1 to 3 years; 3.2 percent, 4 or more years). Of the employed females in agriculture, 12.5 percent had one or more years of college (9.8 percent, 1 to 3 years; 2.7 percent, 4 or more years). The proportion of all farmers and farm managers with one or more years of college appears to have doubled between 1952 and 1970 in U. S. agriculture. Data are from [7].

George S. Tolley, in his study, "Management Entry Into U. S. Agriculture" [45] shows that agriculture is undergoing replacement of one kind of human capital by another because high level management farms experience favorable cost curve shifts; this explains the replacement of many low-level management by fewer high-level management farms.

⁹ Welch [47, p. 55] notes that agricultural research expenditures in the U. S. per farm were \$4.30 in 1940 and \$28.40 in 1959 (in constant 1959 dollars). His estimates indicate that "if research were to fall from \$28.40 to \$4.30 . . . the relative wage of college to high school graduates would fall from 1.62 to 1.43, indicating that one-third of the wage differential would disappear."

adoption of superior and cheaper contraceptive techniques.

The increases in the value of the time of women parallels that of men. Recent studies of the economics of fertility indicate that increases in the value of the mother's time reduce the number of children that parents bear and rear. When the value of time is measured by education, the relationship between additional schooling of mothers and the number of children is strongly negative for the early years of schooling of mothers. Why this relationship should not continue for additional education at the higher levels remains a puzzle.

It is worthy of note that these studies of fertility reveal various functions that the education of parents performs in household-family behavior. The education of parents, notably that of the mother, appears to be an omnibus. It affects the choice of mates in marriage. It may affect the parents' preferences for children. It assuredly affects the earnings of women who enter the labor force. It evidently affects the productivity of mothers in the work they perform in the household, including the rearing of their children. It probably affects the incidence of child mortality, and it undoubtedly affects the ability of parents to control the number of births. The task of specifying and identifying each of these attributes of the parents' education in the family context is beset with analytical difficulties on a par with the difficulties that continue to plague the economic analysis of growth in coping with the advances in technology.

Our approach attributes a basic role to the knowledge-producing sector. With respect to this sector, the assumption is that it produces useful knowledge and that one of the major characteristics of this knowledge is that it is the source of new, rewarding investment opportunities in the quality attributes of both human and nonhuman capital. The derived demand for this new, useful knowledge under these circumstances should show a relatively high rate of return to the investment in producing such knowledge. All of the studies known to me support this implication.

Mindful of our vested interest in research, I am, of course, in good grace in featuring the role it plays in the long-term rise in the price of human time. Our knowledge-producing activities are no longer a trivial sector. This sector has become more organized and there is much specialization. Organized agricultural research, as is well known, has a longer history than most of the other organized research activities. It is also the first to have received major attention by economists; we now have several competent econometric studies that provide estimates of the cost and returns to agricultural research. Included are those by Griliches [12], Tang [44], Peterson [30], Evenson [10], and Ardito-Barletta [1]. The social rate of return to expenditures on non-profit agricultural research is in general high relative to that of most alternative investment opportunities. I have summarized the evidence elsewhere [39, pp. 241-244, Table 12.1]. Robert Evenson and Yoav Kislev have important new studies underway. Meanwhile, I consider it a major advance in economic analysis to treat agricultural research as an endogenous sector as Hayami and Ruttan [13] have succeeded in doing.¹⁰

In a nutshell, then, the increasing economic value of human time is a consequence of the specific forms of new useful knowledge that characterize modernization. Investment in the *quality attributes* of men and women is the supply response. The income share of labor rises, and the personal distribution of income becomes less unequal. The economic dynamics of the adjustment processes is the source of a special premium for the *allocative abilities* of both males and females. As the value of time of women rises, fertility declines and parents opt for more quality per child in place of numbers of children. This, assuredly, is not a dismal economic perspective.

¹⁰ I share the assessment of Hayami and Ruttan on the weaknesses of our knowledge about the organization and management of agricultural research [13, p. 289]. There are several useful leads in some of the papers appearing in *Resource Allocation in Agricultural Research* [11] and in *Agricultural Science for the Developing Nations* [29]. Also see [28].

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Causes and Consequences of Higher Education: Models of the Status Attainment Process*

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SOCIOLOGISTS' interest in education dates back to the earliest days of the discipline. Auguste Comte, Herbert Spencer, Lester F. Ward, Emile Durkheim, Charles H. Cooley, Edward A. Ross—to mention only a few—were writing on the sociological aspects of education more than a half century ago. Although their interests were more in education as a basic institution for melioration and for passing on the social and cultural heritage from generation to generation, they were not unaware of some of the consequences of educational attainment for the individual and for society. The role of education in social stratification systems, however, was first spelled out in some detail by the late Pitirim A. Sorokin in his classic book, published in 1927, *Social Mobility* [33]. Sorokin correctly saw the school to be a major channel of vertical circulation and emphasized the extent to which the school served as a mechanism of social testing, selection, and distribution of individuals within different social strata, thus determining the properties of the different social classes. Much later, Talcott Parsons [18] elaborated on Sorokin's theme in his well-known article, "The School Class as a Social System: Some of Its Functions in American Society." Parsons stressed not only the selection and allocation functions of the school but also emphasized its role in the socialization of the child, particularly in inculcating societal values and norms, and its stress on achievement.

Since the publication of Sorokin's *Social Mobility*, few if any students of social stratification have failed to emphasize the role of education in social mobility. However, it is only in the past decade that empirical studies have begun to appear that give some promise of elucidating both

the mechanisms by which social origins influence educational attainment and the importance of educational attainment in the determination of one's place in the social hierarchy.

The reasons for this are many, but only three will be briefly mentioned. (1) In the past, students of stratification have been preoccupied with father-to-son occupational mobility. The principal tool used to measure occupational mobility has been the mobility table which shows a cross-classification of son's occupation by father's occupation. Although a great deal has been learned from studies using the mobility matrix, it is difficult to decompose the movement between statuses into its component parts. Consequently such analysis has shed very little light on the process of vertical mobility or how mobility is helped or hindered by individual characteristics and experiences or by the events and conditions in society. (2) Past studies have suffered from a lack of appropriate data on large samples of persons—particularly data on social origins, ability, educational attainment, occupational careers, and earnings experience. (3) The multivariate statistical models that are required for the analysis of complex processes, such as those involved in status attainment, have only recently become known to students of social stratification.

Blau and Duncan in their classic study, *The American Occupational Structure* [1], and particularly Duncan [4, 5, 6, 7, 8, 9] in other writings, were the first to overcome these limitations. They suggested a new approach to the study of social mobility—viewing it as a process of status attainment that develops over the life cycle—and indicated appropriate techniques for its analysis. This approach is different from traditional social mobility analysis because it focuses on the degree to which the dependence of occupational status of the son (or some other achieved status) on his social origins (including his father's occupation) is explained or interpreted by experiences or characteristics of the son that intervene between origin and destination statuses. This is accomplished by arraying the relevant variables in a recursive structural model of the socioeconomic life-cycle. Thus the status attainment approach includes, but goes well beyond, the traditional interest in movement among occupations between generations.

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Using data from a 1962 national sample survey of males 20 to 64 years old, Blau and Duncan proposed a causal model of status attainment beginning with educational and occupational status of the father, followed by son's education, son's first job, and son's occupation in 1962. They estimated the dependence relationships in this model through a series of recursive equations. This provided a quantitative assessment of the antecedent conditions of socioeconomic achievement and of the relative importance of social origins and educational attainment for such later socioeconomic achievements as first job and current occupation. In the basic model of Blau and Duncan, educational attainment accounts for nearly all of the effects of father's occupational status and father's education on son's occupational status in 1962. Holding constant social background statuses, education was more influential than the first job in determining later occupational status. Because educational attainment was largely independent of family background, it had a large independent influence on later achievements. These general results hold for the various age cohorts into which the sample was subdivided and indicate the crucial role that education plays in the occupational attainment process. While there are many other analyses reported in the Blau-Duncan study and in later extensions of it [8], these may be less important contributions to stratification research than are the approach and methodology that lie behind the basic model.

The Wisconsin Data

During the same period that Blau and Duncan were at work on their project (beginning in 1959), Sewell and his associates at Wisconsin were engaged in a closely related study of social, economic, and psychological factors in educational and occupational aspirations and achievement. Work was begun in 1959 when Professor J. Kenneth Little [17] turned over a set of data he had collected using questionnaire methods on public, parochial, and private high school seniors in Wisconsin in 1957. According to his best estimates, completed questionnaires were obtained from 95 percent of the high school seniors. Information was obtained on the post-high school educational and vocational plans of the seniors; educational, occupational, and economic backgrounds of their parents; perceived influence of their teachers, parents, and friends on their plans; their interest and action in applying for admission

to college and for scholarships; their opinions about the value of going to college; and a number of related matters. Information regarding the seniors' scores on the Henmon-Nelson Test of Mental Maturity [16], administered annually to all high school juniors in Wisconsin, was obtained from the State Testing Service of the Student Counseling Center of the University of Wisconsin; also, information was obtained from the schools on the rank of each student in his high school class.

From the original questionnaires and punched cards we selected a random sample consisting of approximately one-third of the total respondents; in addition we coded all of the information on all students who scored in the top tenth of the intelligence distribution. After checking for the reliability of coding, some of the original survey data were recoded, and several new indexes were constructed from both the original data and information from various public sources. A series of studies of educational and occupational aspirations, based on the analysis of these data, clearly indicated the important influence of social origins on educational and occupational aspirations, even when the intelligence, community background, and various social psychological characteristics of the students were controlled [12, 19, 20, 22, 23, 24, 28, 31].

In the late spring of 1964, seven years after the students were seniors in high school, a follow-up study was carried out for all students in the one-third sample. Information on the post-high school educational and occupational attainments, marital status, military service, and present residence of these young men and women was obtained from their parents by means of a mailed questionnaire or by telephone interview. After four waves of mailed questionnaires followed by telephone interviews to nonrespondents for whom telephone numbers could be obtained, responses were obtained for 87.2 per cent of the sample. Various comparisons between known characteristics of the 1957 sample and the respondents to the 1964 follow-up study indicate no significant differences between the respondents and the original sample [27].

In the fall of 1965, with the cooperation of the Wisconsin Department of Revenue and following their strict arrangements to guarantee the privacy of individual records, information on parents' occupations, reported income, and number of exemptions claimed—as reported in their 1957–1960 state income tax returns—was ob-

tained for the students who were in the sample. Information on the annual earnings of the male students for each of the years in covered employment since 1957 was obtained from the Social Security Administration, Washington, D.C., following an elaborate linkage procedure for protecting individual identity. These records have now been extended to cover earnings in subsequent years. In addition, information was collected from several published and unpublished sources regarding the characteristics of the institutions of higher learning attended by the seniors. Several articles using these data have been published, and several others are in process [11, 13, 14, 15, 21, 25, 26, 27, 29, 30, 34]. The next section of this paper briefly summarizes some of these results as they bear on the question of the influence of social origins on educational attainment and on the crucial role of education in the status attainment process.

Socioeconomic Origins and Educational Attainment

Before going on to a discussion of the models we have developed to elucidate the status attainment process, it may be worthwhile first to describe briefly some of the results of our descriptive analysis of the effects of socioeconomic origins on educational attainment—which we take to be the *key* variable in the attainment process because it serves both as a status variable of considerable importance in its own right and as a major facilitator of achievement in the occupational, economic, and social spheres. Whatever measure of socioeconomic status we use—parental income, father's or mother's education, father's occupation or any combination of them—we find enormous differences in the educational attainments of the socioeconomic groups. These differences are large regardless of how broadly or restrictively educational attainment is defined—whether it is defined as merely continuation in some kind of education beyond high school, college entry, college graduation, or professional and graduate study.

For example, when our sample is divided into quarters on a socioeconomic status index, we find that a student in the high socioeconomic status category has a 2.5 times greater chance of continuing his or her education beyond high school than one in the low socioeconomic status category. The high status student has approximately a 4 to 1 advantage in entering college, a 6 to 1

advantage in college graduation, and a 9 to 1 advantage in graduate or professional education. In the middle socioeconomic status categories the rates are consistently between these extremes: the lower the socioeconomic status category, the lower the educational attainment. These socioeconomic status differences in educational attainment hold for both sexes, but the educational attainments of women are uniformly less than of men at every socioeconomic level. However, the advantage of males is greatest in the lower socioeconomic levels and least in the highest socioeconomic status category.

When academic ability is controlled by dividing the sample into fourths according to the students' scores on the Henmon-Nelson Test, we still find that higher socioeconomic status students have substantially greater post-high school educational attainment than lower status students. Thus, among students in the top quarter in ability, a student from the lowest category of socioeconomic status is approximately half as likely to attend college or to graduate from college as a student from the high socioeconomic status category. The chances of a high ability student obtaining graduate or professional education, where ability considerations would be presumed to be determinant, are approximately 3.5 times better if he comes from a family with high socioeconomic status than from a low socioeconomic status family. The pattern described above for the high ability quarter is repeated for each ability quarter and for both sexes but is most marked for the lowest ability group—where a student from the high socioeconomic category enjoys a 4 to 1 advantage in attending college and a 9 to 1 advantage in graduating from college. These patterns hold equally well for both sexes.

It must also be pointed out that some members of even the most socioeconomically disadvantaged groups make it through the system to the highest educational levels, and a few from the highest socioeconomic levels do not continue their education beyond high school. Nevertheless, the findings reported briefly above lead to the inevitable conclusion that at least in one area of status attainment—higher education or post-high school education, to be more precise—the members of this cohort found it difficult to escape the effects of their socioeconomic origins. The effects of socioeconomic background operate independently of ability and for both sexes at every stage of attainment in the higher education process. Those who overcome the handicap of status

origin at one transition point find themselves again disadvantaged at the next transition point.

Models of Status Attainment

Beyond the measures of socioeconomic background and measured intelligence used in the preceding analysis, our data include measurements of the individual's performance in high school, perceptions of the influence of "significant others (persons to whom the individual seems to be responsive in making judgments)," post-high school educational plans, and occupational aspirations. This has made it possible to interpret the important social-psychological processes which these variables reflect as potential mediators of the influence of socioeconomic origins on educational attainment. At the same time we have examined their direct and indirect effects on such other attainments as occupational status and earnings. Thus we have been able to extend and elaborate the basic Blau-Duncan model of the status attainment process.¹

Our first causal model was developed to explain the status attainments of the young men in our sample. In this model we began by considering socioeconomic status (as measured by a weighted index composed of father's education, mother's education, parental income, and father's occupation) and academic ability as exogenous variables; then we introduced as

intervening variables son's grades in high school, a significant others index (based on the son's perceptions of encouragement for high educational aspirations by parents, teachers, and peers) followed by son's educational and occupational aspirations; and finally as dependent variables we entered son's post-high school educational attainment and the socioeconomic level of son's occupation in 1964. We first tested this model on farm boys [26], then on boys from various rural and urban subsamples by community size, finally adopting a general model which seemed to work well for all residential groupings [25]. With this model we succeeded in accounting for more than half of the variance in educational attainment and two-fifths of the variance in early occupational status. In addition, the model shows the fundamental role of educational attainment in determining occupational achievement; educational attainment has a large direct effect on occupational status, and it mediates most of the effects of variables preceding it (with the notable exception of level of occupational aspiration).

Hauser, reflecting on this model, suggested that information is needlessly lost by combining the individual components of socioeconomic status and significant others' influence into indexes and by arbitrarily dropping paths of relatively small magnitude. Consequently, as an initial demonstration of this, he further elaborated the model by disaggregating these indexes and retaining all possible paths [14]. This analysis was restricted to a model in which educational attainment was the final dependent variable. The reason for this choice was again our central concern with educational attainment at the time and our conviction that the social psychological variables would be of primary importance in explaining educational attainment.

Recently we extended our model to include occupational achievement and earnings.² The ex-

¹ The differences between our two data sets probably have more to do with the differences in the details of our attainment models than to our differences in sociological orientation. The Wisconsin data differ from the Blau-Duncan data in the following major ways: their data are for a sample of U. S. males aged 20 to 64, while ours are for a sample of Wisconsin high school seniors in 1957. Their data are cross-sectional; ours are longitudinal. Our data include measures of the individual social-psychological variables mentioned above while theirs do not. The latter two facts make it possible for us to stress social-psychological variables in our models, whereas Duncan and his associates for the most part have had to use information from other data sets when they wished to estimate the effects of social-psychological variables in their models. The Blau-Duncan data do not have parental income or respondents' earnings over a period of years, but do have first occupation and occupation later in the respondents' careers. Our data contain Social Security earnings for all respondents employed in covered occupations for the period 1957-67, but this is of course early in the earnings career and may not fully reflect the effects of education; our occupational attainment data are restricted to 1964, the year of the last follow-up. Featherman and Hauser [10] are doing a replication and extension of the Blau-Duncan research in 1973, which will enable them not only to replicate the Blau-Duncan models approximately 10 years later but also to develop new models of the attainment process using additional social structural and social-psychological variables.

² Attention should be called to the fact that the sample to which this model was applied of necessity was restricted to the 1,789 men who in 1964 were in the civilian labor force but not in school and for whom information on 1967 Social Security earnings and all of the other variables in the model was available. The greatest loss was of course due to the exclusion of those in college, many of whom were pursuing professional and postgraduate education. The principal effect of these limitations was probably to lower the means and variances of the variables in the model because such men tend to score high on these variables. This also means that the results reported in other papers [14, 15, 21], although quite parallel to those reported here, are not strictly comparable.

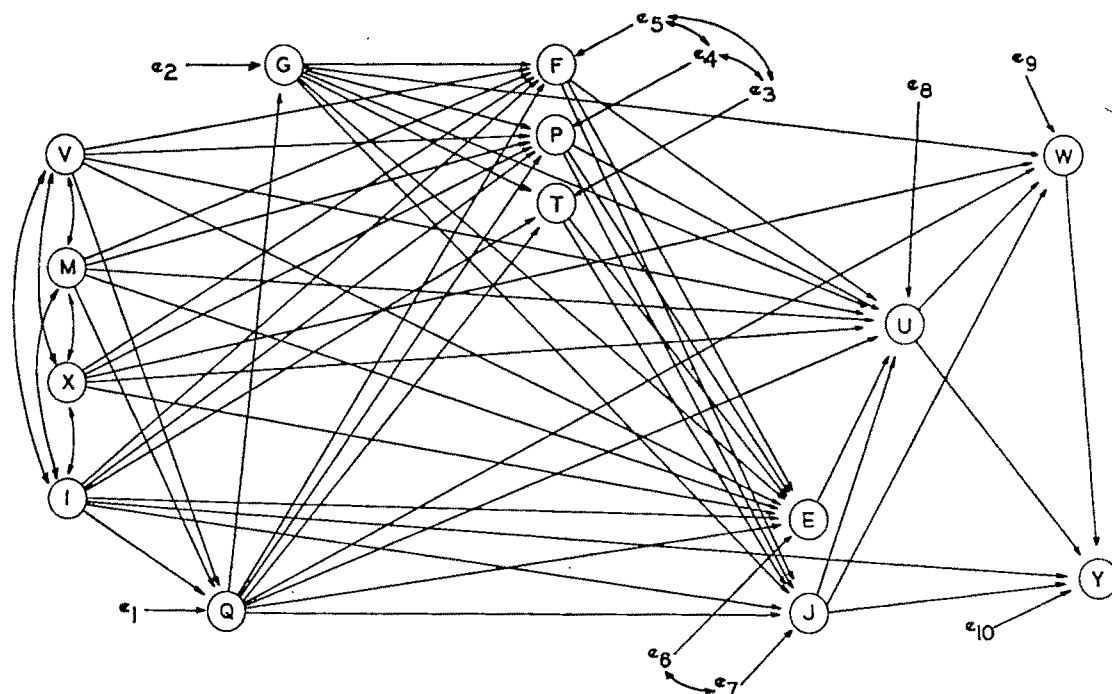


Figure 1. A social-psychological model of post-high school achievement

Variables are: V = father's education, M = mother's education, X = father's occupation, I = parental income, Q = mental ability, G = high school grades, T = teachers' encouragement, P = parental encouragement, F = friends' plans, E = college plans, J = occupational aspiration, U = educational attainment, W = occupational attainment, Y = earnings, 1967.

tended model is described by a path diagram in Figure 1. The curved, two-headed arrows represent unanalyzed relationships, while the straight, unidirectional arrows represent direct paths of causal influence found to be statistically significant. The correlations, means, and standard deviations of the variables are shown in Table 1. In Table 2 we present the final equation for each dependent variable in the model. In the discussion which follows we present only major find-

ings, relying heavily on the interpretation of reduced-form coefficients and other arrangements of the data which have not been presented here.⁸

Educational attainment

We may begin our analysis with a very simple model that includes only the four socioeconomic background variables and educational attain-

⁸For further details about path analytic techniques and the interpretation of recursive models see Duncan [7].

Table 1. Correlations among variables in a model of post-high school achievement: male Wisconsin high school graduates of 1957 with nonfarm background

	V	M	X	I	Q	G	T	P	F	E	J	U	W	Y
V	—													
M	.520	—												
X	.439	.287	—											
I	.321	.247	.448	—										
Q	.246	.205	.181	.178	—									
G	.154	.140	.131	.121	.557	—								
T	.150	.140	.154	.173	.347	.415	—							
P	.248	.231	.261	.241	.345	.315	.437	—						
F	.237	.210	.219	.233	.288	.307	.339	.398	—					
E	.270	.257	.266	.275	.426	.450	.447	.522	.493	—				
J	.227	.227	.242	.238	.428	.460	.399	.477	.455	.755	—			
U	.306	.273	.290	.273	.446	.512	.406	.472	.474	.656	.580	—		
W	.252	.215	.268	.231	.376	.414	.331	.358	.360	.473	.476	.623	—	
Y	.082	.064	.083	.173	.163	.159	.113	.121	.091	.178	.190	.204	.211	—
Mean	10.310	10.514	33.627	650.00	100.67	96.010	.444	.608	.361	.386	49.380	13.298	43.229	757.36
Std. dev.	3.024	2.878	22.543	315.85	14.539	13.642	.497	.488	.480	.487	26.506	1.715	23.409	260.71

Variables are: V=father's education M=mother's education, X=father's occupation, I=average parental income (10's), Q=mental ability, G=high school grades, T=teachers' encouragement, P=parental encouragement, F=friends' plans, E=college plans, J=occupational aspiration, U=educational attainment, W=occupational attainment, Y=earnings, 1967 (10's). Data pertain to 1,789 respondents with nonfarm background, employed in the civilian labor force in 1964 and not enrolled in school, who had nonzero earnings, 1965-67 and with all data present.

Table 2. Structural coefficients of a model of post-high school achievement: male Wisconsin high school graduates of 1957 with nonfarm background

	Predetermined variables													
	V	M	X	I	Q	G	T	P	F	E	J	U	W	Constant
A. Regression coefficients														
Q	.787	.475	—	.00472	—	—	—	—	—	—	—	—	—	84.49
T	—	—	—	—	.523	—	—	—	—	—	—	—	—	43.37
P	—	—	—	.000169	.00514	.0116	—	—	—	—	—	—	—	-1.298
F	.0081	.0147	.00249	.000153	.00619	.0059	—	—	—	—	—	—	—	-1.005
E	.0118	.0121	.00143	.000179	.00364	.0071	—	—	—	—	—	—	—	-1.097
J	.0030	.0088	.00085	.000100	.00346	.0060	.127	.242	.235	—	—	—	—	-1.043
U	—	—	—	.0058	.239	.398	4.42	12.29	12.12	1.190	.0043	—	—	-30.51
W	.030	.022	.0046	—	.0069	.0263	—	.313	.453	—	.1155	6.250	—	8.355
Y	—	—	.0868	—	.0928	.1309	—	—	—	—	.7397	9.123	1.246	-70.41
	—	—	—	.0934	—	—	—	—	—	—	—	—	—	484.9
Predetermined variables														
	V	M	X	I	Q	G	T	P	F	E	J	U	W	R ²
B. Regression coefficients in standardized form														
Q	.164	.094	—	.102	—	—	—	—	—	—	—	—	—	.078
T	—	—	—	—	.557	—	—	—	—	—	—	—	—	.311
P	—	—	—	—	.150	.318	—	—	—	—	—	—	—	.203
F	.050	.087	.115	.099	.184	.166	—	—	—	—	—	—	—	.202
E	.074	.072	.067	.118	.110	.201	—	—	—	—	—	—	—	.168
J	.019	.052	.040	.065	.103	.168	.130	.242	.232	—	—	—	—	.465
U	—	—	—	.069	.131	.205	.083	.226	.220	—	—	—	—	.408
W	.054	.037	.060	—	.058	.209	—	.089	.127	.338	.067	—	—	.540
Y	—	—	.084	—	.058	.076	—	—	—	—	.131	.458	—	.423
	—	—	—	.113	—	—	—	—	—	—	.075	.060	.112	.070

Variables are: V=father's education, M=mother's education, X=father's occupation, I=average parental income (10's), Q=mental ability, G=high school grades, T=teachers' encouragement, P=parental encouragement, F=friends' plans, E=college plans, J=occupational aspiration, U=educational attainment, W=occupational attainment, Y=earnings, 1967 (10's). Data pertain to 1,789 respondents with nonfarm background, employed in the civilian labor force in 1964 and not enrolled in school, who had nonzero earnings, 1965-67 with all data present.

ment. We find that mother's and father's education, father's occupation, and parental income taken together account for 15 percent of the total variance in years of post-high school educational attainment. Whether we examine linear or nonlinear effects, each of the four socioeconomic variables has an approximately equal effect on educational attainment and on all of the intervening variables in the model. This approximate equality of effects of the four stratification variables suggests that there may be little merit in the efforts of some social scientists to interpret all social inequalities in terms of income differences.

The extent to which socioeconomic origins reduce the average educational achievement of those from the lower socioeconomic strata is impressive. For example, each year of father's or mother's education was worth .08 year of higher education for their son—after controlling for the effects of father's occupation and family income. Consequently, the sons of parents with only grade school education obtained on the average one and a quarter fewer years of higher education than the sons of parents who were college graduates, even if their fathers had similar jobs and their families had similar incomes.

A thousand-dollar difference in the annual income of the family on the average also yielded .08 year of educational attainment. Thus a shift from the poverty level of \$3,000 (below which

almost one-fifth of the families in the sample fell) to the median income at that time, \$6,000, increased the average years of education by a quarter of a year when the effects of parental education and father's occupation were taken into account. A shift from \$3,000 to \$10,000 in family income led to an increase of more than half an additional year in post-secondary schooling.

When academic ability is added to the model, the explained variance in educational attainment almost doubles, rising from 15 to 28 percent. The additional 13 percent represents a large component in the variance in the educational attainment of sons which is completely independent of socioeconomic status. An important component, varying between 23 and 40 percent, of the effect of each socioeconomic variable is mediated by academic ability. At the same time, less than one-fifth of the association of ability with educational attainment may be attributed to its association with socioeconomic origins. Clearly, the effect of measured ability on schooling is not merely a reflection of one's socioeconomic status, the assumptions of some social scientists to the contrary.

In order to explain more fully the ways in which socioeconomic origins affect post-high school educational attainment, we further complicate our model by adding three sets of social psychological intervening variables: (a) high

school performance, (b) significant others' influence, and (c) educational and occupational aspirations. On the basis of evidence from our previous research, we believe that these sets of variables intervene in the order indicated and help to mediate the effects of socioeconomic origins and academic ability on higher educational attainment. Taken as a group these intervening variables account for a very large portion of the effects of each socioeconomic status variable on post-high school educational attainment. About 60 percent of the effect of mother's education on son's educational attainment, 70 percent of the effect of father's education, 55 percent of the effect of father's occupation, and all the effect of parental income is mediated by the other variables in the model. Their remaining effects represent the direct influence of resources and discrimination (or perhaps a critic might attribute them to our failure to include some relevant intervening variable). Even with this model, which explains 54 percent of the variance in higher educational attainment, socioeconomic origins continue to influence directly one's chances for higher education.

The extent to which our model explains the effects of socioeconomic origins on eventual educational attainment is remarkable because all of our intervening variables pertain to the secondary school experiences of the men in our sample. Even for young men who succeed in finishing high school, the effects of social background on later educational attainment are largely explained by social-psychological experiences during the high school years.

Again, with this complex model the interpretations for the total associations are generally similar for each of the socioeconomic status variables. Between 25 and 60 percent of the mediated effect of each background variable is due to the higher ability and grades of the advantaged, 30 to 50 percent is due to the higher expectations of their significant others, and the remaining 10 to 40 percent is due to their higher levels of aspiration.⁴

Of course, the model interprets not only the several ways in which the socioeconomic variables influence higher education but also the

effect of academic ability on higher educational attainment. Recall that of the total association between academic ability and higher educational attainment, only 18 percent is due to the mutual dependence of ability and schooling on socioeconomic background. The total effect of academic ability on post-high school educational attainment is large; for each 10-point increase in measured intelligence the average student obtains nearly one-half year of post-secondary schooling. Of this total effect, 84 percent is mediated by the other intervening variables in our model (55 percent by high school performance, 18 percent by perceived expectations of others, and 11 percent by educational and occupational aspirations). Less than one-sixth of the influence of ability is unmediated by the variables in our model. This means that the influence of academic ability can be attributed only in a minor way to socioeconomic status considerations, but rests quite solidly on its direct and pertinent influence on academic performance and its direct and indirect effects on significant others and on educational and occupational aspirations. In this connection it should also be stressed that socioeconomic status has no effect on academic performance in high school independent of academic ability.

Next in the interpretation of this causal model we examine the effects of perceived parental encouragement, teachers' encouragement, and friends' educational plans on post-high school educational attainment. We are struck by the evidence that parental encouragement and friends' plans depend heavily on the son's socioeconomic origin, while teachers' encouragement is more heavily dependent on the student's academic ability and performance. Indeed, teachers are not perceived to engage in direct socioeconomic discrimination, as parents and peers apparently do, but rather depend mainly on judgments of the student's academic ability as it is validated by school performance.

The influence of parents and peers on educational and occupational aspirations and on educational attainment is about equal and about twice that of teachers. Holding constant all other factors included in the model up to this point (the four socioeconomic origin variables—academic ability, school performance, parental encouragement, and friends' plans), we find that perceiving strong teachers' encouragement is worth an additional quarter of a year of higher education, whereas the net value of perceiving strong parental encouragement and of having

⁴In describing how the effects of each variable are mediated, we have consistently referred to the earliest variable in the chain as the mediating variable. Thus, when we say school performance mediates a percentage of the effect of background, this does not exclude the further mediation of those effects by subsequent intervening variables.

friends who plan on college are six-tenths and three-quarters of a year, respectively. Shifts in educational plans and occupational aspirations account for about half the effects of parental encouragement and friends' plans, and they account for all of the effects of teachers' encouragement. Although all three significant others variables have important effects on students' educational attainment, we are led to conclude that teachers' expectations for students do not account for much of the effect of socioeconomic background on higher educational attainment. But far from reflecting overt or covert discrimination, on the whole teachers' expectations appear to be based on students' ability and performance and, as such, make a fundamental though modest contribution to the equalization of educational opportunities.

Occupational attainment

When we extend our model to include early occupational attainment (seven years after high school graduation) as measured by Duncan's Socioeconomic Index for Occupations [3], we observe the central role that post-high school education plays in occupational attainment. Post-high school educational attainment alone adds 9 percent to the variance in occupational attainment explained by all of the other variables in the model. Almost three-quarters of the association between educational attainment and occupational status is attributable to the direct influence of educational attainment; the remaining quarter is due to the mutual dependence of schooling and jobs on causally prior variables.⁵ Each year of education after high school is worth 6.25 points of status on the Duncan scale.

Except in the case of father's occupational status, all of the effects of the socioeconomic background variables on son's occupational attainment are mediated by intervening variables. For parental education and income, about 40 percent of the effect is mediated by academic ability and performance. The remaining effects

are mediated by significant others' influences and aspirations. However, 57 percent of the effect of father's occupational status represents direct status inheritance which is unmediated by any of the intervening achievements in our model. (Since significant others' expectations and educational aspirations ultimately affect occupational achievement by way of educational attainment, so also do the effects of socioeconomic background, father's occupation excepted.)

Just as in the case of educational attainment, more than 80 percent of the association of ability with occupational status represents its direct and indirect effects. A 10-point increase in measured ability leads to an average increase of 5 points in status on the Duncan scale. Of this total effect, half is attributable to the higher grades of more able students, 12 percent to higher perceived expectations of significant others, 7 percent to higher aspirations, and 12 percent to longer schooling; the remaining fifth is a direct effect of ability on the occupational achievement of men with similar levels of academic performance, significant others' expectations, aspirations, and educational attainment. Of the effect of academic performance on occupational status, a quarter is mediated by significant others' influence, about one-sixth by educational and occupational aspirations, a third by educational attainment, and the remaining quarter represents a direct effect.

Net of prior variables, strong teachers' encouragement is worth 3.4 points on the Duncan scale, while high values on the parental and peer encouragement variables are worth 5.4 and 7.4 points, respectively. The effects of teachers' and parents' encouragement are due entirely to their effects on educational plans and occupational aspirations, as is one-third of the effect of friends' plans. The remaining influence of friends' plans is mediated by educational attainment, so none of the significant others' variables directly influences occupational achievement.

The effect of planning on college on occupational status is 6.7 points on the Duncan scale, all of which is attributable to the greater schooling obtained by those with college plans. An increase of 10 points of occupational aspiration on the Duncan scale is worth 1.5 points in occupational status, net of prior variables in the model. It is interesting that this total effect is virtually identical to the regression of son's occupational status on father's occupational status. Only a quarter of the effect of occupational aspiration on occupational status is mediated by educational attainment. The remainder represents an

⁵ Bowles [2] suggests that Duncan and others have underestimated the spurious component in the association of schooling with later social and economic achievements because of a failure to measure socioeconomic background reliably. In our research we have found that no reasonable adjustment for unreliability in our socioeconomic background measures affects our results to an appreciable degree. Moreover, our estimates of "spurious" components of association between schooling and occupation or earnings are increased by our inclusion of socioeconomic variables that are mainly unrelated to socioeconomic background.

effect of aspiration on achievement which is completely independent of socioeconomic background, ability, high school performance, and educational attainment.

It is apparent from our analysis that the path to high occupational status is through higher education. Higher status families appear to make greatest use of this route, perhaps by providing the genes and the stimulating environment that result in superior cognitive abilities and school performance. Further, their encouragement of high educational and occupational aspirations leads to higher educational attainment and, ultimately, to higher levels of occupational achievement. In addition, but to a much lesser extent, higher status families have managed also to provide some further advantages to their sons through direct occupational inheritance, but the evidence from our analysis is that the social-psychological influences which result in higher educational attainment are much more important than direct economic influences.

Earnings

When our model is finally extended to include Social Security earnings in 1967, 10 years after high school graduation, some expected and some surprising findings result. As expected, educational attainment and occupational attainment each play an important role in earnings. Of the effect of educational attainment on earnings, about half is due to the higher paying jobs held by men with more education, and half represents higher earnings within occupations. In the case of both education and occupational status, their effects on earnings represent just half of their correlation with earnings; the remaining half is attributable to the mutual dependence of earnings and of educational attainment or occupational status on prior variables. Net of all prior variables, one year of post-high school education is worth \$178 in 1967 earnings, and 10 points on the Duncan scale is worth \$125.

The most surprising finding is that average parental income during the four years following the son's graduation from high school has the largest effect on earnings of all of the variables in the model ($\text{Beta} = .173$). One thousand dollars in parental income is worth about \$143 in son's earnings (note: earnings, not income) 10 years after graduation from high school. Neither the social-psychological variables nor educational nor occupational achievements explain the influence of parental income on son's earnings; these variables together mediate only one-third of the

effect of parental income. Thus, after all intervening achievements are taken into account, \$1000 in parental income is still worth \$93 in son's earnings. Moreover, none of the other socioeconomic background variables affects earnings, once the influence of parental income has been taken into account. Statistical tests indicate that this income effect is not a consequence of large sampling errors due to multicollinearity among the socioeconomic background variables in the model [15]. Thus, there appears to be little doubt that the intergenerational effect of parental income cannot in any large measure be explained by the differing abilities, social-psychological characteristics, educational attainments, or occupational achievements of the sons of wealthy or poor families.

Academic ability has an important effect on earnings which is entirely mediated by later variables in the model. Of the correlation between ability and earnings, only 16 percent is attributable to the mutual dependence of ability and earnings on socioeconomic background; the remaining 84 percent represents an increase in earnings of \$244 for each 10-point increase in measured intelligence. Of this effect, 38 percent is attributable to the influence of ability on high school performance, 17 percent to its effect on occupational aspiration, and the remaining 45 percent is due to the higher educational attainments of the more able young men. The effects of high school performance are mediated in much the same fashion as those of ability.

Neither significant others' influence nor educational plans have a significant effect on 1967 earnings, but the son's occupational aspiration has a rather important effect on his earnings 10 years after high school graduation. A 10-point increase in occupational aspiration on the Duncan scale is worth \$104 in 1967 earnings, net of all prior variables in the model. Of this effect 11 percent is attributable to the greater educational attainment of those with higher aspirations, and an additional 18 percent is due to their higher status occupations. The remaining 71 percent represents a direct effect of aspiration on earnings; net of intervening educational and occupational achievements, each 10 points in occupational aspiration (on the Duncan scale) is worth \$75 in 1967 earnings.

Other social-psychological and social background variables in the model have little or no direct effect on 1967 earnings. What effects they do have are mediated by educational and occupational attainments.

Conclusions

Our model has proved to be a rather powerful predictor of status attainment. It is especially effective in explaining educational achievement, accounting for 54 percent of the variance. It is a bit less efficient in accounting for occupational attainment but still explains over 43 percent of its variance. It is much less effective in predicting earnings, where it accounts for only 7 percent of the variance in 1967 earnings.⁶ Its better showing for educational and occupational attainment in large measure may be due to the fact that these attainments were probably more fixed by the time they were measured than were earnings. Other evidence seems to indicate that earnings patterns had not stabilized by 1967, when the last data were available for this sample [15]. The most likely explanation for this is the greater investment in on-the-job training among the more highly educated individuals with less labor force experience. We will be following the earnings careers of our sample in the future, and we can test this explanation at a later date.

It is also true that the earlier variables in our model were all selected for their pertinence to educational and occupational attainment rather than to earnings. Important as these variables are, it must be recognized that there are probably more pertinent and proximate influences on earnings that need to be considered in future models. For example, our occupational information is for 1964. We need information on more current jobs. Moreover, job-relevant information, such as years of experience on the job, on-the-job training, and additional formal schooling, would probably increase the efficacy of a model that sought to predict current earnings. Our interest has been primarily to interpret the effects of socioeconomic background on educational and socioeconomic achievements, and we have not yet fully exploited some of the data we currently hold which might improve our ability to specify an earnings function. For example, we can also consider such factors as the extent and timing of military service, family formation, size of family, geographic mobility, and characteristics of the labor market, and similar contingencies that doubtless have some effect on earnings experiences. We plan to restudy our sample during the next 18 months and will gather additional information on these and related matters.

⁶It should be noted that Solmon's [32] semi-log earnings equation explains about the same amount of variance in early income in the NBER-Thordike sample, as ours does when expressed in that functional form.

But to return to our model, we feel that it has been highly successful in the explication of the attainment process in the educational, occupational, and economic spheres—and this is what we as sociologists are concerned with. Our disaggregated model has clearly demonstrated the importance of socioeconomic origins for educational, occupational, and earnings attainments. It has illuminated the rather complex process by which the effects of socioeconomic background on educational, occupational, and economic attainments are mediated by various social-psychological experiences. In addition to the various and sometimes quite indirect paths to status attainment, our model has also revealed that there is a modest amount of status inheritance that is completely independent of these social-psychological processes and is not explained by other variables in the model. Most noteworthy of these are the rather sizable net effects of father's occupation in 1957 on son's occupation in 1964 and of average family income in 1957–60 on son's earnings in 1967. This inheritance of the pertinent status characteristics of the father by the son is indeed remarkable when we consider that the measurements of the son's status characteristics are from different sources and occur from seven to ten years later than the measurements on the father. It is even more remarkable that they persist when other socioeconomic, social-psychological, and attainment variables in the model are controlled.

We expect that better models of the status attainment process will be developed in the future, and we hope to contribute to that movement with the data from our longitudinal research program. We also are cognizant of the interests of social scientists in other consequences of education, such as critical thinking, tolerance, humanitarianism, citizenship, responsibility, and other valued traits.⁷ Perhaps we can develop models to explain these outcomes, but we doubt that sociologists will be very excited about the task that some economists would like to assign to us, namely, the vexing business of obtaining the information that would enable economists to put a dollar value on them. Sympathetic as we are with the usefulness of being able to state everything in dollars, we honestly think you may have about exhausted the pay dirt in this approach to educa-

⁷The literature on the benefits of education has been reviewed in many places. The most comprehensive recent review is by Withey [35]. Withey's book is particularly useful because it stresses the consequences of higher education for economic behavior, political behavior, personality, and life styles.

tional benefits. We invite you to join the small but hardy band of sociologists who seek to understand the process of educational attainment and its

consequences for attainments in other spheres even when they find no way to put a price on its benefits.

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Discussion: LUTHER TWEETEN, Oklahoma State University*

Schultz makes a case for Say's law applied to the market for human resources: a greater supply of resources has led to greater demand which explains why rates of return have remained surprisingly stable despite a huge increase in capital. Presumably, persons who have received large investments of knowledge create a complex world. In turn, persons with large investments of knowledge are required to organize, operate, and manage such a world. Schultz also concludes that earnings from investment in knowledge have contributed to a more nearly equal distribution of income. While this assertion appears valid for the past, it can blind us to current and potential inequities in human investment.

Extensive participation of youth in the investment made available to them in common schools, coupled with the very high rates of return on this investment, goes far to explain the movement toward a more equitable income distribution. While common schools redistribute income toward low income persons [3], higher education has a very different effect [8]. Much of the opportunity to redistribute income through formal schooling has now been exploited in a quantitative sense (measured by percent of students completing common schools and number of days of school per year). Efforts to exploit further the allegedly high rates of return on common schools will have to focus on schooling quality. Here the outlook is not bright, based on the extensive analysis in the various reports from and to the President's Commission on School Finance. A large number of studies reviewed for the Commission as well as the Sewell-Hauser study and an Oklahoma study [7] all confirm that the socioeconomic background of the student accounts for much of the explained variation in student achievement and dwarfs the influence of the school. Thus the role of schooling (one of the few socially acceptable public instruments to intervene in an intergenerational cycle of low socioeconomic status) in development is narrowly circumscribed. Another sobering finding is that special measures, including all types of preschool and remedial programs, lower pupil-teacher ratios, along with more money, in general fail to give clear and consistent indication of improving student outcomes [1, 5, 6].

One problem is that teacher pay scales based on degrees and experience are not related to actual performance (although up to 10 years of experience appears to be beneficial). The educational system needs to employ basic concepts of price theory and sound business management if common schools are to utilize more dollars effectively. The Oklahoma study [7] shows that for rural areas consolidation now offers more opportunities for reducing costs of achieving a given level of output than internal changes in school resource use. The whole area of internal economics of schooling has received far less attention that external economics (rates of return, contribution to economic growth, etc.) and deserves much more attention. "Laissez faire" workings of the education-job-status attainment process depicted by Sewell and Hauser will lead to a new hierarchy of merit and distribution of income that may be no more egalitarian than "old" property hierarchy.

But first we should put to use available research. In a most deplorable and inexcusable oversight, the President's Commission on School Finance failed to recognize the inequities arising from spillovers of schooling investments among funding jurisdictions, although their recommendation that states assume much of the funding now provided by local districts implicitly deals with some of the problem. Major spillovers across state boundaries will continue and require federal funding of up to 30 percent of the investment in schooling [2]. This net spill-over works particularly to the disadvantage of rural states and poorer states, reallocating funds from poorer to richer states. Research indicates that the adjustment in current school funding to an equitable formula, tied to the ability to pay as well as a compensation for spillover, would require a greater readjustment for the latter than the former [2]. Funding formulas can and should be changed primarily on equity grounds: research (for Oklahoma at least) does not indicate that spillovers materially influence local investment [3].

Experiments now underway which provide for at least partial repayment for the public investment in higher education by recipients out of earnings in the years after completion of schooling offers promise to help redress inequities. It could also provide additional funds to reduce

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bottlenecks in supply-short professions such as medicine.

The increasing cost of time is well worth the time of economists to examine. Based on recent research by Douglas Morris [4], the lowest cost of community services is in cities of 300,000, but adding the cost of commuting time makes cities of 10,000–20,000 optimal. The cost of commuting time also may make the farm residence obsolete—it may be cheaper for the farmer to live in town and commute to his farm. We should begin questioning the high cost of subsidizing electricity, mail, telephone, school bus, and other services to open country residents and ask whether it would be cheaper to pay these people to live in town where these services need not be subsidized.

The cost of time is not increasing as fast as Schultz implies. The *marginal* value of time is not high for many persons in economy characterized by underemployment, unemployment, and excess production capacity. When the rigidities of the 40-hour week which make the other 128 hours “fixed” for leisure and other activities (not easily overcome by “moonlighting”) also are accounted for, it is apparent that the value of time has declined for many.

Sewell and Hauser say their model is “a rather powerful predictor of status attainment,” but it accounts for only 43 percent of the variance in occupational attainment and 7 percent of the variance in 1964 earnings. The results also apply

only to one state. The results do confirm the importance of student background found in other studies [7] but reveal a positive peer influence not confirmed by some other studies [6]. Other factors held constant, having high school friends who plan on college adds three-fourths year to higher education. The peer influence provides a case for “busing,” but the effect is small and not without money and other costs. Our Oklahoma study reveals a negative effect of busing time on achievement, *ceteris paribus*. Sewell and Hauser report that a year of post-high school adds only \$178 to 1967 earnings. This implies a low rate of return to schooling—the present value of \$178 discounted in perpetuity at 10 percent is only \$1,780, much less than the cost of a year of college or vocational training in 1967 if foregone earnings are included.

Finally, Sewell and Hauser invite us to join the small but hardy band of sociologists who would rather understand the process of educational attainment and its consequences for attainment in other spheres than to put a price on its benefits. I remind the sociologists that education has a cost and the resources are very limited for meeting the objectives that education is to fulfill in our society. I invite sociologists to be concerned with more than just the *process* and to join economists, educators, and others in determining how best to use limited resources to achieve these objectives.

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Discussion: BRUCE K. ECKLAND, University of North Carolina

Professor Schultz shares, I believe, a quite common point of view with many of us regarding the relationship between education and economic development. This is that education has some in-

trinsic and measurable value, such as demonstrated by the strong positive correlation which he cites between per capita income and education in cross national studies. At the individual level

of analysis, Sewell also presents empirical evidence of the correlation between years of schooling and subsequent earnings. While such findings are not new, they have led many economists as well as others to conclude that education contributes to one's earning power and to a society's industrial and agricultural development because of "something" (besides a diploma) that students acquire as a result of schooling and that this "something" has direct economic utility in the management of time, the development of occupational skills, and in other production functions. As a sociologist, I would like to argue that this view of the role of education is overly optimistic and perhaps even unwarranted which is why, as Schultz himself points out, economic theory fails to explain the persistent and potent rise in the price of human capital.

If I understand Schultz's thesis correctly, he is claiming that the increased share of national income that has accrued to human capital is due to the increased economic value of human time. This value, in turn, has several components, the most important of which is education. Education is of special value, he believes, because it presumably trains people to take advantage of the constant advances of new knowledge. Schultz then applies these principles quite broadly to include not only the economic activities of wage earners but also the activities of women in the home. The latter point he has developed much further recently in another paper [1]. Briefly, the idea is that both the organizational efficiency of the household and the social and intellectual development of the children being reared in the home depend upon the level of schooling of women.

On all of these points, I believe that professor Schultz is basically correct. In particular I think the emphasis he places upon the allocative or coping ability of people resulting from education merits serious attention. Given the speed at which new knowledge advances, the notion of allocative skills and the value of time helps explain why on-the-job training may not be sufficient in preparing people for some occupational roles. Yet, while it is easy to accept the position Schultz takes on these matters, as well as his evidence, I believe the idea that education *changes* the individual in some manner which makes him more useful or qualified to perform his job either on the farm, in the factory, or in the home falls significantly short of explaining the strong correlations between education and economic attainments that have been found at both the individual and societal levels.

There are, I believe, at least three alternative explanations, any one of which could account for the same set of observations. The first of these is that rather than assuming that the economic function of education necessarily involves changing people, it could be argued that educational institutions, in serving the economic establishment, act in concert as gigantic sorting and selecting devices for the allocation of human talent. If it can be assumed that the capabilities to perform occupational roles (which may be labeled general intelligence) are variable across the population, meaning that not everyone can do anything, *and* if the tasks which the economy needs people to perform require variable degrees and kinds of talent, then schools and colleges would seem to serve a viable economic function by simply identifying and certifying individuals for those roles. Although Professor Sewell stressed the importance of social class origins in his summary of the status attainment process, close inspection of his data also points to the predominant position of intelligence and school performance in this process, quite apart from class background. His evidence and that of others supports the view that education tends more to equalize opportunities for talented youth than to restrict them.

Schools and colleges probably accomplish this task in ways unattainable by economic enterprises partly because the schools are the *first* institutions where children are exposed to the universal standards of adult life. Loosened from the particularistic and traditional bonds of the family, children generally are judged at school by what they can do rather than who they are. Again, while there are many individual exceptions, the fact remains that school teachers, college admissions officers, professors, and the like apply universal standards for the most part in their evaluations of students as they advance through the educational system. Thus the ascriptive forces of social inheritance operating through the family are counteracted to a very considerable extent by the meritorious criteria employed in most educational settings. Given my earlier assumptions about the distribution of talent, the economic value of the sorting and selecting process should be self-evident.

The demand for higher education from an economic perspective, then, may be somewhat of a myth, although the demand for talent is quite real. So long as educational institutions can effectively certify who has the talent, economic institutions will rely heavily upon them to do just

that. When higher status jobs are always in demand, it is far easier for employers to screen out most of their applicants on the basis of educational criteria than to take either the time or the risk of costly independent evaluations. Admittedly, a considerable amount of talent, as Sewell's data suggest, can be lost in this process. Nevertheless, almost any student graduating from a reasonably good college with average grades is probably a good risk from an employer's perspective. Moreover, there is an added bonus. Not only has the student proven his ability to learn, he has demonstrated his willingness and motivation to work.

Thus, if income depends in large measure upon the kind of jobs people obtain which, in turn, depends upon their education, then the relationship between education and income might simply involve the kind of selection mechanism just described and have little to do with what students happen to learn in the process.

Yet, probably not even this hypothesis fully explains the correlations generally observed between education and economic attainment. Sociologists have not forgotten Marx's contribution to our understanding of the persistence of class cleavages in industrial societies. Recall Sewell's findings that family background status is implicated in the predictions of school success at virtually every point in the educational cycle. Some sociologists have taken such results to mean that the relationship between education and income is largely spurious, i.e., both who gets educated and who gets rich are the direct consequence of family background factors.

Sewell's work, however, is not totally in accord with this interpretation. His data show that most of the effects of class origins upon the individual's eventual earning power are not direct but operate through the educational system. In other words, if the son of an upper-middle class family fails to go to college, there is not much that the parents can otherwise do to enhance his chances for economic success. Yet the conclusion that Sewell reaches is still basically compatible with what the conflict theorists are saying. That is, since education is generally more accessible to higher socioeconomic groups, our schools and colleges pass on their advantages to their children, even if only indirectly.

Conflict theorists attack the functionalist's position from other angles, too. Besides pointing to the persistent influence of class origins upon educational and occupational attainments, they note that certain occupational groups, particu-

larly the professions, have almost complete control over the recruitment of their members. This alone could explain the close association in some cases between education and income since such groups, if sufficiently powerful, can almost completely deflect normal market mechanisms.

One of the standard features which defines a professional organization is its ability to control the number and characteristics of persons who join its ranks. And, a common criteria for admittance to a profession is having obtained some minimum level of education, usually at least a college degree. Given this determinancy in the selection process, there is little room any longer for the maverick who has not obtained the appropriate credentials. Thus, quite apart from the question of how well prepared an applicant is to enter a profession, the power which some groups can exert over the selection process forces into existence a strong positive correlation between educational investments and occupational attainment.

Finally, let me turn the relationship around altogether and propose, as other critics have, that rises in per capita income or economic development are not the consequence but the cause of increasing levels of educational attainment. This problem, it seems to me, has never been adequately resolved and, of course, is not an either-or question but one of degree and a country's stage of economic development. Certainly in newly developing nations there is good reason to suspect that education up through grammar school has the strong positive economic effects that Schultz notes. However, in an affluent society such as ours where most young people are graduated from high school and a majority of these people are going on to college, one begins to suspect that we have attained a level of educational development nationally that far exceeds the demand or utility from an economic perspective. I suggest that higher education in this country, for many persons who obtain it, is a consumption luxury and that its benefits have little direct or indirect bearing upon production functions.

What information we have about the relevance of education to job performance is scanty but indicates that what many people believe they need to know in their work is only moderately dependent upon their educational experience. What about the tremendous influx of women in higher education in recent generations? It certainly would be difficult to explain the college-going rates of women from a labor economist's perspec-

tive. I even have some difficulty accepting Schultz's argument that educated women make better mothers and housekeepers, although this too may be true. I doubt, however, that these are very sufficient reasons for the rise in enrollments. I believe that for an increasing number of students higher education is a luxury, the benefits of which have little to do with the market place and cannot be counted in dollars and cents. If mass education, particularly mass higher education, has so little economic return for large segments of the population, such a heavy investment in human "capital" must be partly due to the fact that our economy can afford it, which then makes education the dependent rather than the independent variable.

In concluding, let me note that we should not feel compelled to choose between these alternatives. Each, including Schultz's model, probably

has some independent explanatory power. The problem, as I see it, is to design the appropriate experiment or pseudo-experiment that would allow one to either reject one of these alternatives or measure the independent contribution of one while the others are controlled, plus being able to test such models at different stages of agricultural and industrial development. This indeed would be a formidable task probably requiring the joint effort of economists, sociologists, educational psychologists, and others. Since most of us at present seem to talk past one another on these matters, I am not confident that such an undertaking would be easily embraced. Nevertheless, I am convinced we should try.

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Seminar Session 3.0

OUR OBSOLETE DATA SYSTEMS

CHAIRMAN: DEAN E. MCKEE, JOHN DEERE COMPANY

Our Obsolete Data Systems: New Directions and Opportunities THE AAEA COMMITTEE ON ECONOMIC STATISTICS*

THE inadequacies of our data systems have been of increasing concern to the Executive Committee of the AAEA and the American Statistical Association-American Agricultural Economics Association Joint Committee on Agricultural Statistics.¹ Out of this concern was born the AAEA Committee on Economic Statistics which was charged to explore the problems of our data systems and recommend appropriate action to the Association. This paper constitutes a summary view of a major problem we face as professionals, and is the committee's progress report to the Association.

Succinctly put, our data systems are in deep trouble. This is ironic since the systems producing our data have never had more sophisticated statistical capabilities. However, demands we make on this system are now outrunning our investment in its continued development. Most significantly, the conceptual foundation of the system is crumbling—and has been for some time.

There is an even deeper irony to our present data system difficulties, for one of this profession's greatest accomplishments is its early success in conceptualizing and building data systems for agricultural policy and private industry decision making. Econometrics and quantitative methods took root and found early leadership in this profession. The early comparative advantage of agricultural economists among social scientists was in the quantitative and empirical skills that grew out of this experience.

In his presidential address to the American Economics Association in 1970, Professor Wassily Leontief indicted the economics profession for its failure to create an adequate empirical foundation for the highly articulated economic analytics and theory developed over the last several

decades. He specifically excepted agricultural economists from his indictment:

An exceptional example of a healthy balance between theoretical and empirical analysis, and of the readiness of professional economists to cooperate with experts in the neighboring disciplines, is offered by agricultural economics as it developed in this country over the last 50 years. . . . Official agricultural statistics are more complete, reliable and systematic than those pertaining to any other major sector of our economy . . . agricultural economists demonstrated the effectiveness of a systematic combination of theoretical approach and detailed factual analysis. They also were the first among economists to make use of the advanced methods of mathematical statistics. However, in their hands, statistical inference became a complement to, not a substitute for empirical research. [11, p. 5]

Professor Leontief does us great honor, but the honor properly belongs to an earlier generation, for the specialization of the last several decades has brought similar ills to agricultural economics. Among these ills is a growing lack of interest in the data systems that make good empirical work possible. Individually there are many distinguished and honorable exceptions, but as a profession we are vulnerable to this criticism.

Problems of formulating and selecting concepts around which data are gathered seem to be perceived today by most economists as the responsibility of statisticians. Statisticians more correctly see the problem of "what is to be measured" as something that should best be answered by people who use the numbers and the discipline whose theoretical concepts are being quantified by the data system. We are falling into a chasm between these two postures. Consequently, we have been failing to renew our early investment in the conceptualization of agricultural data systems and to develop the entirely new systems of data needed to contend with problems of a rapidly changing economy and way of life.

* The Economic Statistics Committee is composed of James T. Bonnen, chairman; James Hildreth, George Judge, George Tolley, and Harry Trelogan.

¹ The Joint Committee has three ASA members and three AAEA members. The committee has as its primary function an advisory role to the USDA and the Census on problems of agricultural statistics.

The Committee on Economic Statistics concludes that the data systems upon which we depend are in serious crisis. With each passing year, fundamental structural change transforms agriculture and rural life. Thus theoretical concepts around which we have constructed our data systems grow progressively more obsolete—so obsolete that minor tinkering with each census or survey no longer serves to bridge the basic inadequacy of the ideas being quantified [18]. Predictive analyses built upon these concepts perform less and less well despite great efforts at statistical manipulation of data, refinement of technique, and elaborate economic modeling. In addition, we have never really succeeded in conceptualizing theoretical systems that will allow us to understand, measure, and deal effectively with development and various aspects of human welfare. This Committee believes the profession must begin to devote major resources and some of its best minds to the solution of these problems, or see the profession itself decline in intellectual capacity and social utility.

Food and Fiber Industry Statistics²

Technological change has led to a major reorganization of the production and marketing processes for food and fiber. Not only have practically all processing and marketing functions formerly performed on farms been spun off, but also many inputs previously produced on farms, such as power, fertilizer, and fencing, are now produced off farm. Some farm inputs now come in the form of contracted services. In addition the technological nature of many of the inputs has been greatly changed. This has blurred the boundary and meaning of the *farm* sector and leaves behind some myths which we honor through continued statistical use. Improvements in coverage, precision of measurement, and statistical reliability of the past 30 years are now frequently offset by the fact that concepts being quantified no longer accurately reflect the reality of the structure and the behavior of industry.

Obsolete concepts and problems of current data

The farm and the market firm are *basic units of observation* for statistical description of the

food and fiber industrial structure under present conceptual arrangements. In any data system the common building block for all other data the system is capable of producing is the *basic unit of observation*. Farming has become a heterogeneous and functionally dissimilar set of activities and processes. It is simply no longer possible to use the farm as the *basic unit of observation*. The same may be said of the food and fiber market firm. We will continue to need to construct statistics that say something about physical farms or firms of various sorts, but the farm or firm as the *basic unit of observation* from which all food and fiber statistics are constructed is conceptually obsolete.³

No longer can groups of farms be compared or aggregated to a commodity or industry level with statistical results capable of clear interpretation, i.e., we no longer are sure what such data really mean. Of what value is our professional effort and our increasingly sophisticated analytics when the data we use are so often flawed, that the end product of the analysis is poor, and for that reason is not used by decision makers?

We need a new basic unit of observation (or its equivalent), a primary building block, capable of clear definition, from which we can construct clearly interpreted firm level as well as industry level statistics. Only when the basic economic structure of the industry can be described accurately by our data system will analytical accuracy be possible in dealing with the performance and behavioral characteristics that are the focus of most economic analyses. Ideally the basic unit of observation should be compatible across the data systems of the entire United States industrial structure.

In income and output statistics, we have never done a truly adequate job of accounting for assets, simply because this is an extremely difficult dimension to measure. The result is that small capital items, some input supplies, and certain stocks in crops and feedstuffs are not entirely netted out of output and income flows. Also, a number of personal household items end up in the inventory of farm assets. Eldon Weeks comments that,

²We use the phrase *food and fiber industry* to avoid any implication that agriculture is composed only of farms and farmers. This section has benefited from the use of draft materials prepared for the committee by Earl E. Houseman, Eldon E. Weeks, Daniel I. Padberg, and Louis Upchurch.

³The distinction between the definition and the concept of a farm makes efforts to decide whether a farm should begin at \$2,500 or \$5,000 (or any other level) of gross income intellectually futile. Searching for the *right* definition of a concept such as a farm, when the concept itself is obsolete, is intellectually a bootless enterprise.

This reflects the dilemma of whether to define a farm as a business or a household. Much precision could be gained by officially adopting one interpretation alone or both separately. There is much to be gained by detailed description of shares in asset ownership, for both observation of capital flows and computation of rates of productivities and returns. This dictates a high degree of conceptual consistency with output and income accounting measures. [20, p. I]

Several economists, including Weeks, have pointed out to the Committee many limitations and deficiencies of current income and output measures. Many of these problems are simply conceptual failures.

On current account, there is no widespread official publication of the value of total farm output. Farmers' cash receipts may be only as much as 70 percent of the total value of farm output. Gradual incorporation of unvalued output into purchased inputs and cash receipts as farm specialization takes place may yield mistaken interpretations of farm sector growth. Otherwise, the flow measures of farm sector size are conceptually unique to agriculture, based on the traditional assumptions of family farm characteristics aggregated to the national level. The Department of Commerce publishes gross farm product and national income originating in agriculture, but its procedures attribute substantial farm output and income to nonfarm sectors. [20, p. I]

Examination of various Commerce, Census, and USDA measures of income and output suggests not only real conceptual difficulties over what is being measured but grossly incompatible data systems. Gross farm income gets "spliced" into national income accounts and is reported in the Survey of Current Business as "income originating in agriculture." Concepts and data in "gross farm income" are almost totally incompatible with other components of national income accounts, even though they are used for this purpose. Moreover, the national income accounts currently provide no convenient barometer of economic performance of the total food and fiber industry.

The farm gate was once a meaningful base line in measuring farm output, productivity, and prices. It is now pure myth. It leads to odious distortions in the use of statistics. An example is the notion that one farm worker feeds so many consumers. Such statements grossly exaggerate farm productivity since much of the implied increase in productivity is, in reality, due to non-

farm changes in technology and inputs excluded from the computation.

Farm prices are supposed to represent the value exchanged when ownership is transferred at the farm gate. But let's pose the classic question: what is the farm price of broilers when as a result of integration there is no transaction at the farm gate? Even when there is a transaction, the contractual relationship can be quite complicated. The buyer may deduct from this often fictitious value certain charges for services such as liming and fertilizing fields, applying insecticides, or providing field crews for harvesting and packing boxes for shipment. In the case of so-called "plant door prices" supposedly going to producers, additional deductions can be made for delivery to distant plants, grading or sorting services, and the like. Even ignoring "contract production," producing and marketing services become intertwined for an increasing number of commodities. The problem of what is being transferred and at what price raises many questions not answered by our present data systems.

Data to describe the agricultural industry come chiefly from Census and from episodic USDA surveys and studies. The Census of Agriculture has until recently been a census of farms and farm people rather than a census of the food and fiber sector. Only in the immediate past farm census has a major experimental effort been made to enumerate the farm service sectors of the food and fiber industry.

However well the Census of Agriculture may deal with the farming part of the agricultural industry, it has never been adequately coordinated with the Census of Business, Census of Manufacturers, and other fields of periodic data. Nor have USDA data. Each data system tends to have its own basic unit of measurement, industry classification system, and sector definitions. Thus we do not have a complete and coordinated body of data that permits description or analyses of the food and fiber industry as a whole. No one understands all of this better, or is more concerned, than those responsible for the Census of Agriculture and various USDA data systems [16]. It is time economists pitched in to help solve this problem.

It is no longer possible to define the farming sector for some specific products; and for many others the dividing line occurs at different levels in the industrial structure. Since this complexity of structure promises to grow, we need a common conceptual base that is not greatly disturbed by this type of change.

What we as a profession have not yet fully appreciated, is the fact that the entire statistical system has been growing obsolete in a conceptual sense. This is one of the costs of the massive structural and organizational change associated with great increases in the productivity of the food and fiber industry, particularly in the farm sector.

New public and private data needs and issues

Greater interest in the subject of economic planning has developed at the industry level. This is reflected in the bargaining movement and in growing interest in market orders. Industries affected by intense merger activities, such as the Midwestern dairy industry, face the need for facility planning and product flow management on an industry basis. In addition, public appraisal of food and fiber economic activity is increasingly focused at the industry level. Emergence of large processing and distribution structures raises questions of public interest. At the same time, the conglomerate structure, increasingly common at all market levels, makes industry appraisal very much more difficult because firm data can no longer be aggregated into industry descriptions.

Industry planning is being substituted progressively for small independent firm planning and the semi-automatic functioning of the market. Most industry people, while describing this process rather precisely, do not seem able to admit, even to themselves, that in their search for market stability they are replacing the functions of the market. Galbraith and others have described this phenomenon [6]. This is a function not only of imperfect market structure, but also of the increasing complexity of modern technologies and the organizations that manage them.

It is difficult to foresee all data needs that will eventually be generated by these changes. We must start, however, where we are obviously inadequate, i.e., in the availability of stock and flow data on physical commodities aggregated to the appropriate level at which the industry planning function is executed. This must be matched by similar information on the financial transactions. Provision of this data on a comprehensive basis will require far more cooperation of the marketing sectors of the food and fiber industry than has been common in the past. Understandably, marketing firms are nervous about exposing certain types of firm and industry data to competitors and the public. This problem must be faced. With growth, large size firms acquire obligations to the public that must be met, including the disclosure

of data of public interest. Also, as better and more comprehensive private planning data are needed, much of the gathered data is of private value only and must be financed by industry itself. Government provision of such statistics can be justified only where firms and industries are so atomistic that private investment in statistics cannot be recaptured in the market or where there is a major public interest in the provision and accuracy of specific types of data.

As the locus of decision in industry moves to larger aggregates and the industrial structure becomes more imperfect, public policy issues, the kind of public programs implemented, and, therefore, information needs will all change. Demands for greater equity in the effects of public programs in the food and fiber sector have already generated a need for new and better data on the distribution of benefits as well as costs of these programs. Here we have a very inadequate theoretical base and almost no data or very inadequate *ad hoc* data. This question is directly related to the larger matter of management of public programs and criteria for judging them, which are also in flux. In any case, it is clear that public scrutiny of the food- and fiber-related industries will continue to increase in frequency and intensity. To confront these problems, we must begin with a conceptualization or theoretical framework that explains interrelationships within and between the food and fiber sector of the economy and other sectors. This is necessary, among other reasons, to give statisticians guidance on what units to count, items to measure, and flows to report—from the standpoint of the utility of such data to the economic analyst as well as to the farmer and market firm decision maker. We must not only redesign our basic unit of observation, but we must also conceptualize the entire data system to provide for more accurate descriptive and predictive capacity. The data system must support both private decisions at an industry level and public appraisals of industry behavior and performance.

Economic and Social Statistics for Rural Society

The economic development of the United States has transformed rural and urban America in very different ways. The growth of rural society, especially its investment in human capital, has lagged in most rural communities. In most major dimensions of human welfare, in health, housing, education, etc., rural people appear to be less well served by society, its private institu-

tions, and public programs [3]. On the other hand, most of the highly valued clean air and water, open green space, and outdoor recreation is to be found in rural life.

What economic and social data we have on the American people and their society are inadequate and now often obsolete, having been constructed around concepts that no longer match the reality of American life. Also, a rising national interest is evident in development of social indicators and measurement of the quality of human life and its environment for public policy purposes. If the more unique needs of rural life are to be recognized and if these national data systems are to realize their capacity for social science analysis of rural problems, rural social scientists must make a substantial contribution to the conceptualization and specification of these data systems.

What we are faced with is not just a demand for social indicators. This happens to be a very visible portion of an increased demand for economic and especially social statistics on American society [7, 10, 12, 14, 17, 21]. There is, in fact, a general statistical reform movement now under way comprised of many different strands of overlapping and conflicting interest. Some would integrate indicators into a social analogue of the national income accounting system [14, 17]. Others argue for data for improved public program evaluation. Some economists press for more articulate micro data. Others see the prime need as generation of data from large-scale social experiments [9]. The idea of integrating federal statistical files into a common data bank also has currency. Finally, the effort of the statistics profession to improve standards of statistical professionalism in government contributes a distinct flavor to the current statistical reform movement [5].

Agenda and issues

These agenda items overlap considerably but can be reduced to a general concern about obsolescence in older data systems, and most frequently, to a need for new and better data.

1. *Developing a new theoretical basis for obsolete data systems* is an urgent necessity. The most clearly obsolete concepts are our demographic ideas. There was a day when enumerating population on farms and calling it *farm population* made some sense. But today, in addition to our difficulty in defining a farm, we find that many farmers do not live on their own farm or on other farms; that much agricultural labor does not live on the farm; and that there are

many people residing on farms who are not employed in agriculture. The idea of a farm population is practically meaningless.

Even what is meant by "rural population" is a difficult conceptual problem. Rural, of course, has always been a residual category to whatever was defined as urban. The very notion of "rural" needs to be evaluated in a conceptual sense. Perhaps we should be measuring something entirely different today if, as some social scientists argue, the rural and urban populations are now so much alike that there is more variation *within* rural and urban than *between* them. In any case, we need to be clear about what demographic concepts need quantification. The basic difficulty lies in the fact that the term "urban" has never been adequately conceptualized. Thus one must recognize the interdependence between any effort to reconceptualize the notion of what is rural with that of what is urban.

Improved demographic information is needed both for area and community development and for local problem solving. Better information is needed on such matters as fertility, migration, and occupational, economic, and social mobility—to name only a few categories.

Another general set of concepts clearly obsolete is that of rural labor market constructs. These constructs were never very well developed, and the strong agricultural orientation has, as rural society has grown, left us with inadequate rural labor market data built upon an outmoded conceptual base.

2. *Better measures of social well-being* are needed whether in health, education, personal safety, housing, income and employment, or leisure and recreation. But very confusing arguments arise between those who visualize social indicators as norms versus those who seek purely descriptive or positive information. Some also seem to view indicators as a technique in evaluating program performance, not just overall societal performance. In any case, it is quite clear that social indicators, however formulated, cannot do all the things being suggested for them. Finally, some perceive social indicators as simply a first step toward a comprehensive system of social accounting constructed as an analogue to national income accounting. The conceptual feasibility of this is directly contested by others as a logical impossibility [1]. There are more than just a few difficult logical and practical problems to overcome before social accounting is a reality. Still, others suggest (perhaps because social accounting is perceived as an impossibility) that the national

income accounting system should be modified to take into explicit consideration external social costs and benefits needing consideration in social decision making. This correctly views the national income account system as a complex accounting structure yielding many kinds of information. One of the more outrageous intellectual vacuities floating around among some social indicator enthusiasts is the notion that the national income accounts system produces only one piece of information annually, GNP, and that this statistic is useless.

There is much current activity in this area of concern. The National Science Foundation, the National Bureau of Economic Research, the National Academy of Sciences, the Social Science Research Council, Resources for the Future, and the Brookings Institution are all interested in various aspects of social indicators or social statistics. An extensive literature has begun to develop. Legislation was introduced again this year to create a Council of Social Advisors to the president with responsibility for developing an annual social report [8]. Under direction of the Statistical Policy Division, the Office of Management and Budget has undertaken to develop, from existing data systems, a set of social indicators and a publication format for their circulation [19].

3. *Program evaluation* is an increasingly strategic need to which our data systems are now poorly prepared to respond. To the traditional program management emphasis on efficiency has been added a growing concern for the equity and general social performance—not only of public programs but also of some of our society's private institutions such as the medical delivery system.

4. *The income and asset distributions of rural society* need to be explored. The fact that 40 percent of United States poverty is found in rural areas has led to increasing concern about income distribution. Data giving only frequency distributions of current income do not allow much real understanding of what generates the income distribution. Education, life cycle savings decisions, the distinction between property and nonproperty income, all of which are related to age, importantly determine income distribution.

5. The need for improved *environmental quality data* parallels the need for social indicators as well as complements it. Here the initial need is accurate description of what is actually happening to the environment in its several dimensions, as well as greatly improved knowledge of the in-

terconnections of various technological and biological systems by which such things as agricultural chemicals become pollution problems. Many agricultural economists are already working hard in this area.

6. *Knowledge of capital investment* structures, while it has been improved over the last three decades, still is well short of our needs for understanding the economic behavior of society. We need better knowledge of the capital investment process, particularly with respect to human but also physical capital formation. This constitutes one of the primary limitations of our present national income accounts and is a strategic dimension to understanding the development process.

7. *Time as an economic and social variable* needs exploration. The amount and use of nonwork time is being recognized as of great importance to people's well-being, and yet nonwork time behavior is completely neglected in usual measures. A most obvious lack, particularly important for rural people, is information on the amount of time worked, as well as commuting time, which is great and varies substantially among rural people with nonfarm jobs.

8. *Regional and local area development data* systems should be developed. Research in regional economics has led to the application of input-output and other more recently developed techniques to the understanding of overall growth of rural areas. The Committee on Regional Accounts and other groups as well as individuals have done much work on local area data. Some of these needs tie directly to the social indicators problem [4]. They are urgent in view of the recently enacted Rural Development Act of 1971 which authorizes in excess of 10 million dollars to start relevant research and extension projects. A common data base could be very advantageous.

9. *We need better statistics on nonfood and fiber sector economic activity* in rural areas. As a profession we have ignored these other sectors entirely too long. If we are to work genuinely on the problems of rural life and on the further development of that society, we must look far more broadly than at just the food and fiber sector. Clearly, better data is necessary for the assessment of problems, for planning purposes, for evaluation of performance, and for the administration of the public and private organization of rural life.

It is quite clear that the greatest flaws in our data systems arise from our failure to conceptualize social problems in a systematic manner and

to match this with equal concern for the design of statistical systems to measure social system phenomena. Measures of any dimension of social welfare are foredoomed to failure unless they have an adequate social theory base explaining the relationship between the social entities being quantified. The major reason the national income accounting system has been as successful as it has is simply due to the great Keynesian and pre-Keynesian theoretical investment that went into the conceptual foundation of that system. Data systems constructed without an adequate conceptual base may be statistical systems, but they will have limited normative meaning or descriptive power and will be inadequate when put in place.

Agricultural economists have a major intellectual obligation to contribute to the development of an adequate data system for societal needs. This is a must if the rural areas of the nation are to become viable communities of reasonable growth and if rural people are ever to attain levels of human welfare comparable to the rest of society. The unique characteristics of rural society are not likely to be recognized in the construction of a national system of social and economic statistics, unless rural social scientists take an early and active role in the intellectual investments leading to development of those data systems—a process already well under way.

Organization of Federal Statistical Services

As we pursue design of new data systems and modification of older systems, we must deal with organizational issues. Many of these are inherent in all organization, but others arise from current government reorganization proposals and efforts at statistical reform.

One major such notion is the present administration's effort to centralize the federal statistical system. How far this centralization will proceed remains a fuzzy question. One of the earlier proposals involved transferring the Statistical Reporting Service (SRS) and some of the Economic Research Service's current functions (at least in data collection and processing) out of the Department of Agriculture. This would be a most serious step, because it would isolate analysis from the management of the data systems, which due to specialization is a problem even now. Considering treatment of SRS in several past executive budgets, one wonders if such reorganization were not intended to suppress rather than improve many present food and fiber data systems. However, we should not react defensively. We

should think about how best these data systems should be organized. Centralization versus decentralization is a battle as old as bureaucracy and good cases can be built for either approach, *depending on the specifics of the situation*.

Another issue of concern is the capacity of our data systems to service the locus of use. Many data systems of the federal statistical establishment are not very responsive to users. Agriculture is unique for its far more intimate and functional interface with users which accounts for some of the great strength of USDA data systems. Would centralization weaken this responsiveness to user needs? Extremely decentralized systems generally exhibit inefficiencies (e.g., duplication and inadequate scale of operation) and lack of compatibility with other data systems. Even within government statistical usage there are major issues of service to users in the conflict between administrative needs and policy-making requirements. This is a serious conflict that is rarely faced in a direct and thoughtful manner.

A third issue is that of the economics of data collection where computer and electronic data processing have changed the scale of efficient computational operations so greatly that centralized computer utilities are a logical consequence. Whether this means the eventual use of only one or a very few computational centers for the entire federal statistical system is debatable, however, particularly if values other than efficiency are served at all. If one had to wait as long for crop and livestock market statistics as we do now for Census of Agriculture data, one might as well quit collecting most data. Since Census is a perfectly competent organization with the greatest computer and data processing capacity in government, the problem would appear to be a question of the priorities given to the Census of Agriculture and thus the resources made available. A very high percentage of the value of much data is perishable. In these cases if data are not timely, the taxpayer might be better served by elimination of their collection.

Substantial differences in scale economies are associated with different functions of data systems. While processing exhibits large-scale economies, efficient scale of organization for data planning (statistical design) and analysis is very much smaller. But how much? Minimum efficient scale of organization of data collection and its distribution probably fall in between. The Office of Management and Budget's proposed reorganization of the Federal Statistical System would separate into one organization (1) collection and

processing and into another (2) the planning, analysis, and distribution functions [15]. How adequate is this approach? What does it do to the integrated functioning of the system and to effective service of the user?

Access to data and effective integration of statistical data systems is another issue of major importance. Presently it is often impossible for one agency of the federal government to gain access to data of another on a timely and comprehensive basis. This is due to bureaucratic barriers and to real or imagined limitations of confidentiality. Protection of confidentiality is a serious legal obligation but hardly an adequate explanation for the failure to allow data to be used for legitimate statistical purposes.

Conclusion

We have described some major problems. Yet rapid technological and social change creates an even more important problem. Extremely fast societal change produces situations in which data systems are faced with the necessity of frequent redefinition of what is being measured as well as the necessity to adjust statistical measurement procedures to those changes. Have we not reached the point where the overpowering problem is not so much the difficulties described above but rather the question of how to design a statistical data system with the capability of continued adjustment to social change? We must have a competent theory of social information processing before this is possible [2]. Ideally, what we need is not a *right* definition of a concept or even a *right* concept, but a system in which we have the flexibility to match concept and measurement to differing and changing objectives.

We have tried here to describe a serious professional problem. Whether our difficulty is obsolescence in current data systems or the need for entirely new data, a necessary first step is an intellectual investment in specifying or developing the theoretical concepts to be measured.

It is inescapable that the answer to the question of what is to be measured must have a solid

conceptual foundation or what actually gets measured will lack in significance and utility [13, p. 372]. Conversely, it is also true, as Leontief argues, that social science theoretical concepts can neither have *proven* value nor be improved upon without adequate empirical testing [11]. This is an iterative process of great interdependence. Better empirical measurement depends ultimately upon improved theoretical concepts, but, in turn, theoretical advances ultimately require improved measurement capability. The path to substantive new positive knowledge (not just theoretical hypotheses) of necessity involves both the inductive and deductive. Thus, we are, by the very nature of knowledge, involved in a continuing iterative process, not a single leap to some ideal situation.

No dimension of the problems described will be solved easily. Immense practical as well as conceptual difficulties exist. We must develop a step-by-step strategy in which many varied actors who design, manage, and use data cooperate to retrieve our data systems from the intellectual chaos that now threatens.

We should not imagine that the kind of progressive conceptual erosion described in this report is limited to the data systems upon which rural social scientists depend. It is a problem which all social scientists must face soon and seriously, or see the social sciences decline in intellectual capacity and social utility. Our critics are already saying that we have little to offer today that is useful.

As long as economists think about these problems only at the level of "data gaps" and as difficulties to be bridged by fancier models and better statistical techniques, they are fiddling while their entire house burns.

We face a difficult but exciting and challenging prospect. The Economic Statistics Committee believes that economists must devote major resources and some of the best minds to solving these problems. We challenge this professional association, particularly its younger members, to place these problems high on their research agendas.

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Discussion: JOHN E. LEE, JR., FPED, ERS

The subject of statistical systems is important. The AAEA Committee on Economic Statistics has done a good job on a very complex and neglected subject. But the real service rendered by Bonnen and the Committee has been to move the "data systems" issue higher up on the list of the profession's priorities and higher in the rankings of "prestigious" activities. The committee report makes the convincing case not only that our data systems are in disarray, but also that conceptualizing the food and fiber industry and the rural sector and designing data systems consistent with those concepts are worthwhile, relevant, and thoroughly professional activities. If this committee does nothing more than to jolt the profession and those in positions of responsibility into an awareness of the urgency of revitalizing our data systems—and of the magnitude of the task—it will make worthwhile the grueling agony and effort invested by Committee members to date.

But I hope for far more than this. The needs and problems spelled out in the report must be translated into a specific plan of action—by the profession and by the federal agencies with sta-

tistical and economic responsibility—and by the universities that will have to furnish much of the brain power.

One reaction is that the committee report has more to say that is useful about food and fiber industry statistics than about people and social statistics. Perhaps this merely reflects the fact that we have a system of industry statistics that we criticize and get specific about. We do not even have that to start with on the people side. Furthermore, the latter subject is probably more complex and certainly more diverse, thereby increasing the difficulty of conceptualization and of a systematic approach.

Nevertheless, I was disappointed that the Committee was not able to go beyond a laundry list—albeit a useful one—of issues and problems that establish the dimensions of social data needs. Perhaps a special subcommittee is needed to give the subject of people and social statistics the attention it deserves but rarely gets.

A second overall observation is that the Committee identifies problems with the data system but tells us little about what to do about them.

Admittedly, it would be unfair to expect the Committee to have developed detailed plans for solving all the problems. But the committee members, having spent many months and many meetings on all aspects of the data problem, are undoubtedly in a better position than most to offer specific suggestions.

Food and Fiber Industry Statistics

The Committee accurately describes the basic problem with our food and fiber industry statistics as one of a deteriorating conceptual base. Permit me some additional observations and comments.

Early statistical work by Schultz, Taylor, *et al.* grew out of efforts to quantify and analyze farmers' problems. Now, as a society we face these and different problems, so our traditional data do not answer all the questions we now must ask. Along with changes in the structure of the industry to which Bonnen has alluded has come a change—at least in emphasis—in the role of the publicly-employed agricultural economist. Increasingly he is called upon to be an analyst of the food and fiber industry, responding to the concerns of the larger society, rather than an analyst (and often advocate) for the farmer and other firm level decision makers.

As the nature of the industry has evolved and the nature of the public concerns and issues related to it have changed, efforts have been made to update the statistical series built around the old conceptualizations of the industry. These efforts have been reflected in numerous revisions of both USDA and Census data series and much effort on the part of such groups as the USDA Statistical Review Board which only recently completed a comprehensive review and evaluation of USDA data series. These refinements, however, have not overcome the conceptual difficulties. Thus, the problems with our data series cannot be corrected short of redesigning the entire data system around a relevant conceptualization of the food and fiber industry.

Time and space preclude an itemization of specific data needs for the food and fiber industry. Obviously our focus must be on the meaningfulness of data to answer relevant questions about the industry. Much of the crop, livestock, and price data now collected by the Statistical Reporting Service would still be needed.

One point should not be overlooked: there is still a real need for traditional production economic data such as enterprise budgets and pro-

duction functions. They are essential to extension production economists and to policy analysts and researchers who deal with broad issues but who must begin their analyses with knowledge of decision processes and constraints at the firm level. I mention this because assembling data of this nature has dropped out of favor as economists in ERS and in universities have turned to more glamorous and lofty tasks. As a result, much of the firm data base assembled in the 20 years following World War II is drying up or out of date.

One of the confusions resulting from the changing structure of agriculture—and carrying over to the related statistical systems—results from failure to distinguish between functions that are performed and where and by whom these functions have traditionally been performed. Whether a farmer harvests his own grain or applies his own pesticides versus hiring these operations done on a custom basis, the same production functions are being performed. There has been a substantial shift toward functional specialization in the food and fiber industry, but our statistics have been built around the firms which performed the functions when the industry was conceptualized. Thus, as farms, for example, have become increasingly functionally specialized, our statistics about the farm sector have become increasingly misleading because many of the functions once included are no longer properly accounted for. The need exists to distinguish between functions being performed and the units of observation and to insure that the statistical system provides for effective monitoring of the functions.

One is tempted to elaborate on the proper units of observation and on the functions to be monitored, but time and space preclude that. I will suggest that for serving various needs, data should probably be collected for several units of observation at successively higher stages of aggregation (plant, firm, parent firm, subsector, etc.), and the interrelationships between these units of observation should be documented.

In discussing new public and private data needs and issues, Bonnen states, "... All of these influences lead to a need for a data system which will support private decisions at an industry level and public appraisals of industry behavior and performance." I agree, but I would assert that for the publicly-employed economist, the latter is most important. However, Bonnen later states, "... as the need for better and more comprehen-

sive private planning data arises, much of this must be financed by the industry itself. The tradition of almost total government provision of statistics for the farming sector is applicable only where firms and industries are so atomistic that such private investment in statistics cannot be recaptured in the market and thus is not feasible as a private function."

I want to agree, but this creates a problem. Much of the same data needed by industry is also needed by the public sector to analyze the behavior and performance of the industry. Bonnen would have industry take care of its own needs. But this leaves the other purpose of a better data system—the analyses to serve society's interests—unmet and public analysts at a serious disadvantage. Certainly we do not want duplicating data systems. Neither could we charge industry for public data that are provided gratis to everyone else. Thus while Bonnen's point is proper in principle, I feel that as a practical matter we have to be thinking of a largely publicly supported and maintained data system.

So far we are better able to explain what farming is *not* or what concepts of the food and fiber system are *not* valid than to explain what the proper concepts are. That is, we can prove that the old concepts are no longer useful, but we cannot prove what concepts are useful. Perhaps what Bonnen and the Committee have *implied* but have not said—and it should be said *explicitly*—is that we need first to assemble a critical mass of research resources to do empirical research on what the new structure of agriculture really is before we can realistically conceptualize the industry for purposes of designing data systems.

My only comment on the organization of federal statistical services is to stress the need for maximum communication and feedback between those who collect and assemble data and those who use them. The propensity to neglect the conceptual base for data systems has been increased by specialization and by institutional separation of the work and functions of statisticians and agricultural economists.

Where Do We Go From Here?

What do we do now? Let us suppose there is consensus in the profession that our data system is obsolete and that the need is to articulate a new and relevant conceptual base. The committee report offers no assistance in what to do next. Neither the Committee nor the American Agri-

cultural Economics Association is in a position to insure that resources will be brought to bear on the conceptualization problem or that more resources will be forthcoming to the federal agencies to build the desired data system. Who has the responsibility for action?

Support for major changes in our statistical system may be difficult to muster. Despite Bonnen's suggestion I do not feel it is realistic to expect much of the effort to be funded by private industry. Congress will not likely support costly changes. In the first place, it will be difficult to get Congress to consider statistical systems as an issue of much priority. Second, if Congress did give the subject attention, it would not be easy to convince them that problems with present data systems warrant the cost of new systems. Finally, before Congress would act, it would be necessary to convince the many established constituency groups with vested interests in the present data systems that change was in their best interest.

So, there is a big gap between having the Association agree on the problem and having the data agencies in a position to do something about it.

Two tasks remain: (1) develop new conceptual frameworks for industry and social statistics and (2) develop effective means of getting new data systems built around the concepts. With respect to the first task, I repeat my earlier statement that efforts at conceptualizing may be unproductive without considerable empirical research on the actual structure of the industry and of the economic and social interrelationships that are important to monitor in the rural sector.

We need means of challenging the best minds in the profession to tackle these tough and practical problems. I offer these suggestions: (1) arrange for an AAEA competition for the best work on developing a conceptual base for industry statistics and social statistics; and (2) recommend the establishment of a joint ERS-SRS statistical implementation task force to work parallel with the AAEA committee and to staff out recommendations and develop implementation plans.

(M. L. Upchurch, University of Florida, who was originally scheduled to be a member of the discussion panel, probably should be listed as co-author. Some of his suggestions and views are included, but since he was in Iran on an AID assignment when these notes were written, and therefore unable to defend himself from my use and misuse of his ideas, his contribution and assistance are simply but gratefully acknowledged.)

Discussion: EDGAR S. DUNN, JR., Resources for the Future, Inc.

I think the AAEA Committee On Economic Statistics is to be commended for a report of major significance. I have read almost every report and article written in the last 10 years related to issues of statistical reform. Insofar as official reports go, this one is in a class by itself. In the report the Committee modestly declined credit for the Leontief accolade on behalf of the current generation of agricultural economists. But if this report is an indication, that current generation may be positioning itself to take the vanguard of social science once again in this domain.

The report does not go far in making specific program suggestions, but it does something all other reports have failed to do. It asks the right questions and comes close to an appropriate representation of the problems. From this report I get a sense that an important segment of professional social science may be prepared for the first time to begin at the beginning.

The most startling aspect of this report is the frank recognition that "the problem is bigger than we thought." There is a sense of shock in recognizing that our data problems create a crisis so fundamental as to raise serious questions about the meaningfulness of current social science. This alone makes the report worthwhile, for what bothers me most about the current state of social science is that *it should be in a state of shock about these matters and is not*. But I will go one step further. I have become convinced that these problems are not only bigger than we thought, they are, for the time being, "bigger than we are." There are a number of instrumental reasons why this is so, but the difficulty is primarily conceptual. The core of our obtrusive information processing problems is not apparent to our usual modes of thought. Here, again, the Committee has recognized this fact and emphasized it convincingly, but it still does not appear to recognize that the problem is a generic one deeply rooted in the processes of social cognition. I would like to make this claim and extend the implications of the report's discoveries.

In a forthcoming publication of my own I give this generic information processing problem a name. I call it the "entity problem." I do so because the entire social process is based upon our ability to give *representation* to our *concepts* of *social systems* or *social entities* through statistical and other cognitive means. Organized purposive social entities use data to represent their own

structure and behavior, to represent the structure and behavior of other purposive social systems to which their behaviors relate, and to represent patterned ecological interrelationships between behavioral entities that make up their operating environments. The statistical representations we construct for these purposes amount to efforts to *parameterize our concepts* of the interrelationships that form social entities of interest.¹

In social science and social behavioral organization we have a problem of conceiving and representing social entities different in character from the entity problem of other sciences. The entities we deal with are neither as unambiguously defined nor as permanent.

The content of a social system being observed is as varied as the purposes and conceptions of observer systems. The same social events may be common components of different conceptions of different observers that satisfy different social purposes or intentions. For some purposes the descriptors attached to the data perceived to represent a relational concept may be different from those that serve another, even though the same event is being monitored. This yields the fact that data generated to yield a statistical representation of one conceptual entity may not be quite appropriate as an element in representing a different, though related, conceptual entity. The social entities with which we deal are as varied as the combinations of relationships that all observers conceive to be relevant for their purposes. These are potentially infinite and constitute a principal reason why social science has never been able to practice entity taxonomy in the manner of the physical and life sciences.

Even more devastating is the impermanence of social entities. At one point in time a social entity may manifest relationships that over time are substantially modified without losing their coherence as an entity. When this occurs, the entity's continuing representation requires a different set of perceptual data. The old set fails to inform the process of social cognition adequately.

¹These statements imply an epistemology of social systems not yet adequately developed in social science but fully consistent with modern epistemology and what science knows about human information processing. It recognizes that perception is an iterative process of testing our conceptions of the world by developing means of representing our concepts through the use of properly selected real world data.

Social entities are adaptive systems that can be given accurate state representations by the same data set for only short periods of time.

It is the purpose-related and impermanent character of social entities that create a special set of data and information processing problems for social science and social organizations. It is this class of "entity problems" that underlies virtually every data problem and problem of statistical organization one can identify.

The report of the Committee graphically illustrates how the impermanence of statistical entities over time vitiates the meaning of many recurrent statistical representations. The Committee displays an accurate and unusual grasp of the "entity problem" by pointing out that our established systems of recurrent data have become obsolete because they were designed to give representation to a set of conceptual entities no longer adequate to serve our information processing requirements. Hence, it quite appropriately gives emphasis to the necessity to revise our concepts before we can adequately revise the data systems we use to parameterize them.

However, in my view, there is an element of incompleteness in the report as it stands. The report implies that this is largely a matter of displacing our concepts and then reconstructing a data system more appropriate for giving representation to them. I fear that our problem is more serious than this. We are in a time when the technology of human artifacts and social processes are changing rapidly. Human and social purposes are evolving as well. Increasingly, our information processing requirements are related less to the management of relatively steady-state throughput systems and more to the implementation of developmental activities directed to changing our concepts and representations of social structure.²

Thus, the displacement of concepts and the revision of data systems are not one-time or occasional adjustments we must face (save occasionally with regard to fairly stable management systems). It has become a continuously ongoing process that we are currently managing poorly because our data systems were never conceived to support such a continuously changing process of social cognition.³

In response to the pervasive effect of the entity problem a number of strands of statistical reform have been proposed. There is the social indicator movement, the extended social accounting movement, the microdata movement, the data banking movement, etc. In the main, their response to the debilitating effect of the "entity problem" is to propose the filling of recognized data gaps in our recurrent data archives and improving the effectiveness with which they may be retrieved and related. But these proposals fail to recognize the root character of the entity problem. If carried to their logical conclusion, such reform would, indeed, confirm the fears of those concerned with the issue of personal privacy and yield recurrent archives containing "all there is to know about everyone"; except that long before this point we would become paralyzed by data overload, and before that we would, in most cases, become overwhelmed with the expense.

What we need at this point is to develop a statistical servicing system more specifically designed to generate greater flexibility in the representation of entities. It is true that we probably need to expand recurrent archives and develop additional accounting constructions, but these tend to be temporary and restricted problem palliatives that involve no new methodologies or statistical system concepts directed to the generic entity problem. We need to develop techniques for transforming the descriptors of recurrent archives to satisfy wider ranges of existing and novel uses. We need techniques for generating temporary and special purpose data in ways that they can be meaningfully related to the data in recurrent archives. We need to develop such data system capabilities with some notion of the priorities defined by our most obtrusive information processing problems.

This kind of development cannot be guided adequately by a displacement of our concepts and theories of the nature of the social entities we wish to represent. We need to begin at still more fundamental levels by developing a theory of social information processing that will *enable us to understand the data system better as a system*—so as to design a more flexible servicing capability directed to dealing with the recurrent entity problems inherent in the process of social cognition.

² As well as supporting the innovative implementation of novel aspects of the social process.

³ Also, I might add, because historically most of our social science concepts and concepts of social organiza-

tion are restricted to the study of systems that manage the throughputs of society than to the study and initiation of social development.

Seminar Session 3.0

OUR OBSOLETE DATA SYSTEMS

Subsession 3.1—Food and Fiber Industry Statistics

Chairman: R. JAMES HILDRETH, Farm Foundation

Discussants: Eldon E. Weeks, ERS, USDA, "Perspectives of the Farming Sector for National Economic Accounting Purposes"

Norman M. Coats, Ralston Purina, "Our Obsolete Data Systems: New Directions and Opportunities: Discussion"

Nathan M. Koffsky, International Bank for Reconstruction and Development, "Our Obsolete Data Systems: New Directions and Opportunities: Discussion"

Subsession 3.2—Social and Economic Statistics for Rural Society

Chairman: GEORGE TOLLEY, University of Chicago

Discussants: Clark Edwards, ERS, USDA, "Discussion of Social and Economic Statistics for Rural Society"

J. Patrick Madden, Pennsylvania State University, "A Model for Social Indicator Research"

Raymond D. Vlasin, Michigan State University, "Some Key Considerations in Development and Use of Statistics"

Subsession 3.3—Organization of Federal Statistical Services

Chairman: HARRY C. TRELOGAN, Statistical Reporting Service, USDA

Discussants: Daniel B. Rathbun, Bureau of Labor Statistics, U.S. Department of Labor

Walter W. Wilcox, Library of Congress, "Organization of Federal Statistical Services with Special Relation to Agriculture"

Robert B. Pearl, Office of Management and Budget, "Reorganization of Federal Statistical Activities"

Subsession 3.4—Contributed Papers

Chairman: PAUL L. FARRIS, Purdue University

Papers: W. D. Dobson and Harlan Hughes, University of Wisconsin, "Restructuring Outlook Information Systems to Meet Management Needs of the 1970's"

Jerry A. Sharples, ERS, USDA, "The Corn Blight Watch Experiment: Economic Implications for Use of Remote Sensing for Collecting Data on Major Crops"

Robert E. Sweeney and Timothy Hammelman, Land Bank Management Information System, "User-Oriented Retrieval Systems"

Rodney L. Walker, ERS, USDA, "On An Automated System for Developing Enterprise Budgets: The ERS Experience"

Robert Zellner, University of Guelph, "A Solution to the Problem of Undersized Samples"

Seminar Session 4.0

FOREST RESOURCE POLICY AND MANAGEMENT

Chairman: WILLIAM LEUSCHNER, Virginia Polytechnic Institute

Public Pressures and Values, Federal Policy Changes, and Future Timber Supply

JOHN MUENCH, JR.

Not too many years ago one of our forestry schools was considering dropping its course in forest policy. At that time the school curriculum was heavy in the biological sciences and in quantitative methods. The course in forest policy was one of those chore courses that no one on the faculty was much interested in. As a result, forest policy was taught as a dry history course with little analysis and virtually no discussion of current problems and future trends.

I felt at that time, as I do now, that the study of forest policy is essential to the professional development of all foresters. The professional forester needs to understand that public values and pressures will dictate what future forest practices will be prohibited or encouraged. Only then will he be fully responsive to public desires.

Before proceeding much farther it might be useful for me to define what I am talking about. In my mind policy is the framework of principles upon which day-to-day decisions are based. There are three different sources of policy. The first is cultural, being formed in the traditions of a society. We take these for granted, and it is only when we look at other cultures and the ways they regard their forests that we can appreciate the cultural roots of some of our own attitudes. The forestry profession also has its traditions brought to this country from Europe when the profession was being developed in the late 1800's and early 1900's. These traditions continue to have a considerable impact on the way timber is managed, especially on publicly owned lands.

Cultural factors are subject to change but only when there is a significant effort with leadership to inform the public about the consequences of continuing the old ways and the benefits of the new ways.

The first wave of conservation is a case in point. The frontier spirit had many Americans

believing that they could always find more timber over the next hill. They felt, therefore, that there was no need to replant harvested areas or to prevent forest fires. It was only when the last hill had been crossed and the dim prospect of future wood shortage was realized that some thought leaders were able to summon public pressure to do something about it. In the space of a relatively few years public values had changed. New public pressures led to the reversal of many of the land laws which earlier had fostered destructive exploitation of forest lands. Whereas earlier forests were places for hostile Indians to hide and to be cleared for agriculture, the new ethic, which continues strong to this day, regarded timber as a resource to be nurtured. Many people seem to have carried the new ethic to an extreme by regarding tree cutting as sinful. Accepting that, it follows that those who cut trees, therefore, are evil. Here we see the phenomenon of the persistent custom in a society where the reason for the custom—in this case, timber supply—has been forgotten.

The second source of policy is the legislative source. Policies from this source are more explicit than those from tradition, although their development is limited by what cultural values will permit. In American forestry they include laws affecting federal lands, such as the Multiple Use-Sustained Yield Act of 1960, and laws, such as the Cooperative Forest Management Act, which indicate something of how the public would like private forest lands to be managed.

There has been no significant change in federal forest policies from the legislative source since the Wilderness Act of 1964. While new legislation has been enacted, it has not set new directions in policy. This does not mean that the Congress has neglected examination of forestry issues. The proposed Timber Supply Act of 1969 enjoyed much discussion and support before it failed to reach floor debate in February 1970.

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Within the past year Senator Hatfield's proposed American Forestry Act, S.350, and Senator Metcalf's proposed Forest Lands Restoration Act, S. 1734, also enjoyed much support from various quarters. However, neither appears to have much chance for passage in its present form. All three of these bills would have set out new policy directions, especially as they pertained to the federal lands. But public support was not sufficient and opposition was too great for them to gain passage.

Although the National Environmental Policy Act (NEPA) has had a significant impact on many federal activities, for the Forest Service the most important result of NEPA has been more public involvement in planning for timber management, land use, and other activities and projects. In other words, federal law now requires that the public be involved in shaping of Forest Service administrative policies.

The third source of forest policy is at the administrative level. Whether it be on private or public lands, the administrators of forest properties can make basic decisions upon which lesser decisions are based. This can be seen in the way the Forest Service is altering its management, within the constraints of existing laws, to shift emphasis away from timber production and toward production of other forest values. On private forest lands many companies have prepared and presently follow written policies designed to make forest management more responsive to the desires of an increasingly vociferous public.

Some further examples will serve to illustrate the points I have been making. Beginning perhaps in the early or mid-Sixties and culminating with Earth Day on April 22, 1970, there was a nationwide propaganda campaign against air and water pollution and the general degradation of the livability of the earth for mankind and other creatures. This campaign induced a cultural change similar to that of the first conservation movement. In its wake came criticism of many forest practices, especially clearcutting. The combination of clearcutting with terracing of hill-sides for replanting in highly visible areas of the Bitterroot National Forest in Montana focused nationwide attention on the Forest Service. Publicity concerning this specific incident in an environmentally-conscious public was followed by similar revelations on other national forests. The Forest Service became fair game and its policies and practices soon became discussed on the floor of the Congress and in the media nationwide. Legislation was introduced to ban clearcutting

which, although it was not passed, led the Senate Interior Committee to prescribe guidelines for the Forest Service to follow in the use of clear-cutting [8]. The strength of public opinion also forced the Forest Service to take steps to correct past errors and make sure they did not happen again. That the Forest Service was responding to public pressure is evident in the 1970-71 *Report of the Chief of the Forest Service* [2]. In 1971, responding to the charges made on the Bitterroot and other forests, the Forest Service published a study of 30 problem areas concerned with timber production [10]. The problems involved publicly sensitive esthetics, as well as regeneration, resource planning, road systems, and other subject areas which were being discussed publicly. That study was followed by the recent publication of an action plan for each of the 30 problem areas [11]. All the recommended actions involve an increased sensitivity to the public's desires for a more pleasing natural appearance as well as the need for more careful planning and execution of timber management activities. It is obvious that public opinion has had its impact on the administrative policies of the Forest Service.

But what has been the impact of these policy changes on the volumes of timber being produced? In looking over the policy changes I can distinguish two major kinds of impacts: one involving forest practices and the other involving land use. Limitations on forest practices, such as the use of pesticides and prescribed burning, while affecting timber productivity, have had no measurable impact on timber production so far. Their impacts will be felt in the future if their prohibition from use and the failure to develop alternatives lead to reduced timber growth. Even with clearcutting, limitations on the size of clear-cut areas may affect the ability of forest managers to replant cutover areas economically, possibly leading to a decline in use of genetically improved seeds and seedlings and inadequate stocking from natural sources. Such effects will be revealed only when timber inventories in the future show growth to have been adversely affected. Such a result will require that harvest rates be reduced to maintain sustained yield relationships.

With the issues involving land use, however, the impact upon volume production is more easily and immediately measurable. Their effects are reflected in current timber production. For instance, where clearcutting has been eliminated on certain forest areas because of esthetic or water quality purposes, the net effect is a shift in land use, not merely a shift from one method of pro-

ducing timber to another. It is not that timber production has been excluded from such areas, but the intensity of timber production has been reduced in favor of the production of other benefits. A recent Forest Service study [13, p. 19] of six representative national forests in the West reports reductions in the timber base from such land use conflicts ranging from 0.5 percent to 19.1 percent. The biggest reductions, however, occur in withdrawals of land from the commercial forest base for wilderness and similar purposes. On the national forests it has been estimated that withdrawal of the so-called "de facto" wilderness areas will reduce the annual allowable cut by about 1.75 billion board feet, a reduction of about 13 percent from the allowable cut total of 13.6 billion board feet.

To what extent have public pressures been responsible for these realized and potential reductions in the annual harvests from national forests? A great deal, I am sure. And it is interesting to trace how those pressures arose.

The Sierra Club, of course, has been one of the more militant organizations in having land withdrawn from commercial management and placing it into the National Wilderness System. In March 1969, when prices for softwood lumber and plywood reached new high levels that threatened the attainment of the nation's housing goals, both houses of the Congress conducted hearings into the situation. During the course of the hearings it became increasingly evident that the solution to the problem being studied resided in more adequate funding for timber management on federal lands, which held 60 percent of the nation's inventory of softwood sawtimber, and especially on the national forests, which held 54 percent of the total softwood inventory. The idea of new methods of funding national forest timber management were explored during the hearings, including the following colloquy among Congressman John Dellenback of Oregon, Senator William Proxmire of Wisconsin, and Brock Evans and Lloyd Tupling of the Sierra Club:

Mr. DELLENBACK. Mr. Evans, do I understand correctly that—I believe you mentioned this in your testimony—you do back the concept of adequate continued funding for the Forest Service?

Mr. EVANS. Yes, certainly.

Senator PROXMIRE. And this is the feeling of the club, that some sort of proposal to give them the wherewithal on a continuing basis would be desirable?

Mr. TUPLING. If I could interject a com-

ment, Mr. Dellenback, yes, we do believe that more intensive management of the commercial, the areas that are designated for commercial timber purposes, would be of benefit not only in the production of sawtimber, but if this could be done it would relieve the pressure on the wilderness areas which we are trying to protect. So essentially there is no conflict in our position.

We would like to see the commercial areas developed to their very fullest and in this way we would protect the wilderness areas that have a natural and scenic value.

Mr. DELLENBACK. So then in refinement of the question which Senator Packwood asked of the club, you feel those areas which are to be commercially managed, with the type of things Mr. Evans spoke of, recognition of other benefits, you would feel that there ought to be the best type of intensified management for commercial purposes?

And point 2, you would see the funds for this made available to them on a steady, continuing basis?

Mr. TUPLING. Yes. I intend to testify before the Appropriations Committee to that effect [9, p. 657].

Out of these hearings, Senator Sparkman, Chairman of the Senate Committee on Banking and Currency, whose committee has jurisdiction over housing matters and whose committee held the hearings into the lumber price situation, developed the proposed Timber Supply Act (S. 1832). The bill would have provided for 65 percent of the earnings from national forest timber sales being retained for investment in tree planting, thinning, fertilization, and other cultural measures to increase the productivity of timber lands. Allowable cut rates would have been adjusted to reflect the prospective growth as soon as the cultural measures had been carried out. All of this would be required to be carried out within the constraints of the Multiple Use-Sustained Yield Act. The bill was also introduced into the House and enjoyed wide sponsorship in both houses. But before hearings could be held on the bill, the money supply tightened, the mortgage situation was reversed, and the housing demand for lumber and plywood collapsed. The feeling of urgency was lost.

There must have been numerous sessions in the offices of the Sierra Club in the two months between the price hearings in March and the hearings on the Timber Supply Bill. By May the Sierra Club had reversed its position on funding for national forest operations and had begun a nationwide campaign against the bill. It is easy

to understand why. Any measure taken to increase timber growth on forest land can immediately be reflected in an increased rate of harvest from existing inventory. Since most of the inventory on national forests is in the old growth timber located in currently unroaded "de facto wilderness" areas still classified as commercial forest land, approval of the bill would eventually lead to *increased* harvesting in the very areas coveted by the Sierra Club for addition to the National Wilderness System. The club obviously felt it needed all the time it could get to have the unroaded areas legislatively withdrawn from the commercial land base and therefore it should oppose any efforts to promote timber growth. Similarly, the club could easily have reasoned that anything which could be done to slow the rate of growth in already roaded areas would result in a statistical overcut that would be reflected in a reduction of the allowable cut and, in turn, a *reduction* in the rate of harvesting in the unroaded areas. It would therefore follow that preservation objectives would be served not only by opposing steps to increase their growth but also by promoting measures to reduce growth.

The strategy of the Sierra Club leadership is obvious to those who understand how allowable cuts are established where the timber inventory is predominantly old growth. And the club has been consistent in carrying out the strategy. It has made every effort to call attention to the relatively few examples of timber mismanagement on national forest lands. It has made clearcutting a national issue which far exceeds the seriousness of the errors that have been made where the practice had been misapplied. It has unjustifiably extrapolated the results of good research, notably the Hubbard Brook experiment [6], to scare the public. It even passed up the opportunity to support a motherhood conservation issue, Congressman John Kyl's bill (H.R. 13089), to provide funding for reforestation of the long existing backlog of 4.8 million acres of cutover and burned over land on the national forest land in need of reforestation.

Also consistent with the club's apparent strategy is its opposition to softwood log exports. On this issue it takes every opportunity in the press to criticize the export of the softwood logs and has succeeded in stimulating Congressional hearings on the issue. There can be only two bases for this opposition: (1) relating to the presumed effect of exports on the rate at which forest land is harvested and (2) regarding the prices which American consumers might have to pay for wood

products in competition with foreign buyers. On the first point, the assumption that exports lead to more forest land being harvested is not supported by fact. Data for the State of Washington, where more than half of the volume of logs exported originates, show that there has been no significant change in the area of forest land harvested annually on all ownerships since 1962, when exports were only a small percentage of their present volume [3]. This is because the increased harvest volumes represented by exports are coming from thinnings in second growth timber and the use of previously submarginal logs on areas already being harvested, rather than the harvest of additional areas. The second basis for opposition, concern for consumer prices, has not been evident in any other actions of the Sierra Club.

The propaganda campaign which the club mounted to defeat the Timber Supply Bill had plenty of time to operate. The collapse of wood products prices and the weight of other more pressing matters resulted in a delay to February 1970 before the bill was brought to the floor of the House. By that time the environmental movement was in full bloom. The club had succeeded in making timber harvesting an environmental issue on par with air and water pollution. A flood of letters to Congressmen against the bill had been inspired by the club's campaign, and the resolution to debate the bill on the floor of the House was defeated. Technically, the bill was not defeated since it was never debated on its merits. But the effect was the same.

This is certainly an outstanding example of public pressures and values influencing forest policy and, in turn, future timber supply.

Considering the demands being made only a year earlier that timber production should be increased, how could the Sierra Club have been so successful in defeating the bill? To answer this question one need only look at the level of general public understanding of forestry matters. A recent public opinion survey conducted by the American Forest Institute and *Newsweek* magazine revealed that 66 percent of the nearly 1000 individuals interviewed felt that the nation's forests are being exhausted. Another survey of environmental editors of 21 major magazines showed that 33 percent felt that the U.S. would run out of trees within 100 years, 24 percent did not know, and 43 percent thought we would never run out of trees [1]. Obviously, most of the public and the editors were susceptible to the flood of information sent to them in the campaign

which characterized the bill as giving the forest industry a license to rape the national forests.

The battle continues even today. The strength of the campaign by militant preservationist groups and the receptivity of the public for the preservationists' message are the major forces shaping forest policy today. The climate created in the Congress for preservationist initiatives against proven timber management practices and for massive withdrawals of timber land from the commercial forest base have required continued vigilance on the part of the forest industry to protect its raw material supply. The receptivity of the public to its objectives has also encouraged the Sierra Club and the other militant preservationist groups to be more active in the courts. One need only read Justice Douglas' scathing dissenting opinion against the Forest Service in the Mineral King case to appreciate how strong the possibilities are that some decisions against timber management could easily be reached [4, p. 4402].

The effects of court actions and administrative decisions to avoid court actions are that some 2 billion board feet of national forests timber sales are now being withheld from the market. When compared to the Forest Service annual allowable cut of 13.6 billion board feet, the reduction caused by land use conflicts can be seen to be significant. Recently the Sierra Club entered a suit against the Forest Service (*Sierra Club et al. vs. Butz et al.*) to hold up the classification of the roadless national forest areas that should be retained in the commercial land base and other roadless areas that should be nominated by the President for addition to the National Wilderness System. The suit is generating considerable interest, and several industry associations and companies have been allowed to intervene as codefendants. There is also a possibility that county governments dependent on revenue-sharing payments from national forests and other organizations interested in continuing these lands in multiple use will also ask to be permitted to intervene as codefendants. This court case could easily be the most important step in determining the course of forest policy since the Multiple Use-Sustained Yield Act of 1960.

At stake is the use of about 50 million acres of national forest land, of which some 35 million acres are now classified as commercial timberland. The annual allowable cut on this land is about 1.75 billion board feet. Loss of the timber on this land from the timber inventory would necessitate a reduction of the total Forest Service

allowable cut from the present level of 13.6 billion board feet to perhaps 10 billion board feet for a number of years in order to make up for the statistical overcut, after which the allowable cut could rise to about 11.9 billion board feet annually, other factors remaining constant.

The issue of how federal forest lands should be used is secondary, of course, to the issue of whether the federal government should own land at all. And here too the public has expressed itself. Perry Hagenstein [5] reported, "that the Public Land Law Review Commission found that public sentiment apparently strongly favors continued federal ownership of forest lands—so strongly that the Commission believed recommendations to dispose of a significant part of it would be futile—suggests that existing ownership patterns can be accepted as public forestry policy as modified to meet changing needs."

When the impact of changing public values and pressures upon national forest lands are summed up, the results are very disquieting to the forest products industry. The industry owns only 13 percent of the nation's commercial forest land. It is, therefore, highly dependent upon other ownerships for its raw material supply. Unless steps are taken to increase the productivity of lands remaining in the commercial forest base, the outlook for timber production in the future is not bright when compared to the expected market demand. While it is true that there will be increased imports of timber products, almost entirely from Canada, even this source leaves the total supply far short of the demand that could be expected at recent price levels.

The preservationists frequently suggest that by increasing production on private forest lands more federal lands could be withdrawn without losses to the consumer. This is at least partially true. But the objectives of private forest ownership are not always consistent with increased timber production. Furthermore, the manifold problems of providing technical and financial assistance and fire protection and overcoming the diseconomies of small-scale production make the small private ownerships, which constitute the largest portion of this ownership class, very difficult to work with. Federal policy already encourages, albeit inadequately, timber production from farmers and other private forest landowners. Ironically, many private forest owners may have been influenced not to harvest timber by the preservationists' propaganda. Also ironic is that by training public opinion against the forest industry, a climate may have been created favoring

repeal of the timber capital gains provisions of the federal tax laws. Loss of this provision would likely lead to significant reductions in private timber investments, especially on industry-owned lands. A final thought here is that the present condition of the nonindustrial private forest lands makes it unlikely that, no matter what policy steps are taken to improve their productivity, significant increases are unlikely to be realized in their harvests for 30 years.

The preservationists also suggest that substitutes could be used in place of wood for many uses. By now it is well known that the negative environmental impacts from the production, use, and disposal of wood products are generally much less than those from other materials which might be used as substitutes for wood. There is also a growing appreciation of this fact in official circles. The interim report of the National Commission on Materials Policy [7, p. 39] had this to say on the subject:

... High timber prices would also result in greater use of substitutes. However, there are likely to be substantial environmental, economic, and social costs associated with the increased use of substitute materials. Timber is a renewal (sic) resource, unlike most competitive materials. Wood products are biodegradable. Wood can be processed with relatively little pollution and with relatively low energy requirements compared with most competitive materials.

The purpose of the Commission set forth in Title II of the Resource Recovery Act of 1970 [7, p. 2] is:

... to enhance environmental quality and conserve materials by developing a national materials policy to utilize present resources and technology more efficiently, to anticipate the future materials requirements of the Nation and the world, and to make recommendations on the supply, use, recovery, and disposal of materials.

Should the Commission make recommendations favoring the use of wood over other materials which are adopted as national policy, a counter-trend to the recent preservationist movement could easily develop. The public would have to make a choice between preservation and a cleaner environment. It is easy to see that even the most ardent environmentalist could be torn by such an issue. As usual, the conflict over land use would be a conflict for the public's minds. But this time many who have supported the preservationists in the past would be on the other side of the issue.

I do not want to overstate the importance of a possible preservation versus clean environment issue. Substitutes have already replaced wood in many uses. That is evident when the historic data on per capita lumber consumption are studied. Price-induced substitutions of one material for another will likely continue to dominate use patterns. Probably none of us feel now that our past welfare has been eroded in this regard, and I doubt that the consumers of the future will ever stop to think how much better off they might be materially if they had more wood to use. But government intervention in the market to influence the use of materials might have a substantial effect on materials use patterns also.

While discussing possible future policy directions, I should briefly mention the work of the President's Panel on Timber and the Environment. This panel was appointed by President Nixon in 1970 to study and recommend how timber production, especially from federal timber lands, can be increased consistent with other multiple-use objectives of forest land management. The panel is thoroughly studying the alternatives and is expected to make its report by the end of 1972. It is conceivable that some of the recommendations will call for changes in legislation for all forest lands, as well as changes in the methods by which federal forest lands are managed.

Experience with the Timber Supply Bill confirmed that no matter how sound new policy might seem to those who must work with it, opposition by the public can defeat it. The Timber Supply Bill can be characterized as sound because its development was shaped over the course of several months in numerous meetings between public and private foresters, conservationists, politicians, and others. Even after the bill was lost, a funding proposal for timber management on the National Forests very similar to the one in the bill was recommended by the Public Land Law Review Commission. [12, p. 95].

The point here is that no matter how sound the recommendations of the National Commission on Materials Policy, the President's Panel on Timber and the Environment, and the Public Land Law Review Commission might be on technical and economic grounds, if the public is not receptive, the recommendations will not be adopted as policy. While recommendations favoring timber production and use might give the use advocates more tools to work with, the static inertia of public opinion against use, as indicated by current opinion polls, now seems to favor the

advocates of preservation.

How public pressures and values will effect policy changes to increase or decrease future timber supplies cannot be predicted. Too much depends on the magnitude and direction of efforts by the government, industry, preservation organizations, and other groups to influence the public mind. We can only hope that whatever deci-

sions the public wishes to have made in its behalf are made with a full understanding of the consequences of the various alternatives. This will require that foresters, economists, and others knowledgeable in forestry matters make every effort to set the record straight whenever it is distorted and otherwise be activists in improving public knowledge of forestry and land use issues.

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Discussion: RICHARD A. SKOK, University of Minnesota

Muench has clearly set forth the present major policy issues and the principal antagonists involved in articulating the future role of the national forests as producers of timber. Federal policy formulation must not become myopic, however, with respect to federal land policies if we are to meet future timber supply needs adequately.

While I would consider federal lands as an important continuing source of timber supply, it would seem many factors mitigate against its continuing for long as a base beyond a 15 to 20 percent contribution to annual harvest. Federal lands until relatively recently supplied less than 10 percent of the nation's annual timber harvest. Thus, 20 percent of our commercial forest land now supplies about 30 percent each year. The three states designated the Pacific Northwest alone account for about 60 percent of volume and 75 percent of value of federal timber harvest. Unroaded, old-growth sawtimber in this area is estimated to provide the basis for such harvests for an additional 30 to 35 years under existing policies. Many of these stands are prized by in-

dustry for their value in processing and by others for their potential in recreation-wilderness if allowed to remain undisturbed. They provide the logical harvest areas to move towards regulation of the forests involved. But once removed through harvest, these federal lands will provide the same opportunities for future timber resource production as similar lands under different ownerships.

Federal policy through cooperative programs with states has explicitly demonstrated public interest in timber management on privately owned forest lands over at least the past half-century. Realistically, federal policy must shift increasing attention and accomplishment to these lands if it is to significantly step up long-term domestic production.

This largest ownership category, the nonindustry private forest ownership, accounting for about 303 million acres or 59 percent of our commercial forest land was only briefly noted by Muench. It is discounted, he states, because of (1) lack of clarity in owner intent regarding timber production and (2) the likely inability to achieve mean-

ingful increases in harvesting for 30 years. But on balance, are the means available to us less adequate to meet the challenges these many small ownerships present than those on federal lands? Our effort to date has been much less. The many points raised in Muench's paper might well make one ask whether the national forest "owners" have a clearer purpose in timber management on these lands. But beyond this is the persistent glimpse one acquires that for the long term the need exists for a set of policies addressing the entire system of forest land ownership that will enable us to shoot with a rifle rather than with a shotgun to accomplish the timber supply and attendant objectives we seek.

It has been argued elsewhere that a part of our current problem with the nonindustrial private forest lands in this country has been the past conservative policies with respect to release of timber supply on federal lands. This developed a market burden responded to by private owners and led to disinvestment in their growing stock. Thus, today only about 50 percent of our annual harvest comes from this 59 percent of what is classified as commercial forest land. If sawtimber alone is considered, an even bleaker picture is discernible.

Overall public policy has tried a variety of means to ameliorate these problems. But relatively, our efforts have been meager. In 1971 there were 878 service foresters provided by federal and state funds to work with nonindustrial forest landowners under the 1950 Cooperative Forest Management Act authorization. This represented one professional to provide technical assistance per 345,000 acres—hardly a measure capable of the task at hand.

Cost sharing under the ACP (now REAP) Program originated in 1936 and is concentrated in two practices for timber production: A-7 tree planting and B-10 timber stand improvement. In 1968 only 1/10th of 1 percent of the nonindustrial private forest land received cost shares for treatment under these practices. Typically, total cost shares in recent years have been \$3.5 to \$4 million per year or a little more than one cent per acre—again, not meaningful if a major impact for future timber supplies is to be sought.

Efficiency criteria applied in policy choices would find higher average inherent productivity on private forest lands. The capability for response is there. The process of land disposal in this country prior to the initiation of reservation

for national forests beginning in 1891 meant the more remote and often less productive land was available to be reserved. Admittedly, to date we have done poorly in developing criteria for effective applications of existing federal assistance programs on private forest lands. Our measures of accomplishment have been weak and need strengthening to improve effectiveness.

Recognition of the need for improvement of management on private and nonfederal public lands is shown by the Forestry Incentives Act (S 3105 and H.R. 12873) introduced by Stennis and Sikes, respectively. These bills are presently receiving promising consideration by the Congress. They would authorize an expansion of cost sharing and its separation from REAP. Passage of the Cooperative Forestry Programs Act this year expanded authorization for funding of forest management and protection on nonfederal lands.

Federal policy needs to consider other aspects not noted by Muench in delineating targets. Federal lands are heavily concentrated in the West (more than 75 percent). Nonindustrial private forest lands, on the other hand, dominate in the North (42 percent) and the South (48 percent), east of the Mississippi River. Industrial forest lands are heavily concentrated in the South (54 percent). Therefore, the policies selected and pursued will have significant regional and local economy implications.

As Muench pointed out, it is very probable that timber, in terms of relatively favorable environmental trade-offs, will have high priority in any materials policy adopted for this nation. This seemingly will be the overriding consideration of the future for policies to inspire an adequate timber supply. External benefits produced in timber growing generally yield no cost offsets. External costs incurred in timber harvesting will be eventually reflected in prices for products produced from timber. These have undoubtedly contributed to substitution for wood materials historically. To allow future price-induced substitution by more environmentally demanding materials will be a self-defeating course to follow given the environmental imperatives of our time. Assuming that existing and new knowledge of a materials system, in an environmental as well as an economic framework, supports this conclusion, the direction for federal policy *vis-à-vis* timber supply should be less subject to private interests under the guise of public pressure.

Discussion: CON H. SCHALLAU, Forest Service

During the past decade or so, public concern regarding the use of the nation's forest resources has focused primarily on the extensive margin for timber production. Controversy regarding the extension of the no-cut zone in the Boundary Waters Canoe Area of northern Minnesota, the establishment of the Northern Cascades National Park, timber-harvesting practices on the Bitterroot National Forest and the French Pete Creek area are examples of situations where considerable public debate was generated by proposals to modify or eliminate timber production on economically inferior sites.

Today I would like to discuss briefly the preoccupation with competing uses at the extensive margin for timber production and a correlative preoccupation with the extensive margin for outdoor recreation services.

In April 1971, Secretary Morton authorized a reduction in the allowable cut from O and C lands in western Oregon. Recently, the National Forest System's Regional Headquarters in Missoula, Montana, announced plans to revise downward the annual programmed cuts for certain national forests in the northern Rocky Mountain area. The action of both the Bureau of Land Management and the Forest Service is, in part, evidence that temporarily at least the extensive margin for timber production on public lands has shifted backward.

But, is the public timber supply situation all that bleak? Perhaps not, according to the Marty-Newman analysis [1]. They found that significant increases in timber supply could be generated by some rather attractive investments at the intensive margin.

If opportunities to intensify exist, then why are these investment opportunities not funded? There are probably many reasons, not the least of these being the federal austerity program. However, I believe polarization in the ranks of natural resource users is a major contributor to this impasse. The rhetoric and invectives generated by these users have so energized the political forum that it is simply more expedient for our congressional leaders to ignore any and all proposals for intensive forest management.

Two timber management bills—Hatfield's S. 350 and Metcalf's S. 1734—were introduced during the past year; both would have provided for more intensified timber management. But I do not look for early passage of any legislation

that would significantly affect the supply of timber from our nation's public forest lands. Decisions necessary to achieve more optimal allocation of our nation's forest and associated resources will be held in abeyance until vested interests begin to talk to each other. For example, rather than ignore the merits of each other's claims, industry spokesmen and outdoor recreationists would be more productively occupied if they were to share concern for what is happening to the intensive margins for timber production and outdoor recreation use.

So much for the impasse at the intensive margin for timber production. What is happening on the other side of the fence? That is, what about our outdoor recreation resource and, as an example, the wilderness? If the wilderness enthusiasts become too preoccupied with their extensive margin, the currently designated wilderness areas are bound to suffer. As a wilderness user, I feel qualified to judge that we possibly could "love our wilderness areas to death." Some rather drastic measures are necessary if we are to adhere to the mandate of the Wilderness Preservation Act (78 Stat. 890; 16 U.S.C. 1131-36). I do not believe that contaminated water supplies, overgrazed mountain meadows, exhausted supplies of kindling wood, etc., are in keeping with the spirit of this act. Additional funds and new management prescriptions are needed if we are to protect adequately not only our nation's Wilderness Preservation System but also the continuum of outdoor recreation resources ranging from the roadside picnic table to the mountain pinnacle frequented only by mountain climbers.

If the public forum is, as I have stated, preoccupied at the extensive margins for timber production and outdoor recreation, what can economists do? I would like to suggest a number of topics that, if diligently researched by economists and others, might help focus productive attention on public resource management opportunities at a variety of intensive margins.

Public forest resource managers need models that link the ecological and economic consequences associated with alternative management choices. Such models would certainly ease the analytical burden involved in preparing environmental impact statements while fulfilling their major role as decision tools. Then, too, using such analyses as evidence, perhaps someday we will see Congress considering bona fide multiple-

use budget proposals. Such proposals would encompass all uses *at the same time*. Simulation models linking the various uses—timber, outdoor recreation, water production, etc.—would greatly facilitate the development of unified budget proposals.

We need economic analyses of the environmental management costs and benefits associated with timber harvesting. Currently, we are authorizing costs for mitigating environmental damage while we have little if any basis for judging whether or not such expenditures are economically and ecologically prudent.

Then there is the matter of public vs. private financing of environmental management activities. Congressional funding is low—a factor behind the current slowdown in public timber sale activities. Might it be more economically efficient if the timber industry were to foot the bill? This would be particularly so if an economic analysis were to show that the bulk of the mitigating costs could be shifted to the consumer of timber products—i.e., internalizing externalities—or to the Treasury in the form of reduced stumpage prices.

To date, most economic analyses of outdoor recreation have dealt with demand. This, I suppose, is okay if you are willing to allow Say's Law (supply creating its own demand) to run its course. But, confronted with the growing popularity of a wide range of outdoor recreation activities and the coincidental problems of financing the development and maintenance of valuable public resources, I believe it imperative that we devote more attention to the supply side of the ledger. Outdoor recreation is in many instances a consumptive activity, and we have few if any guidelines regarding how and to what extent maintenance should be financed. Besides, optimal allocation of outdoor recreation resources cannot

be assured until we have sufficient information that will allow us to identify the extensive and intensive margins for competing outdoor recreation demands.

In the past we have treated public outdoor recreation resources pretty much as a "free good." As long as we allow this outlook to persist, this "free good" will be exploited as an expendable item. To avoid exploitation, I predict we will see more use of fee systems. The role of an economist in developing equitable and administratively feasible fee systems should be self-evident, as is his role in examining alternative investment arrangements. In this regard, I would hope someone would soon examine how the provision of free or "near-free" recreational activities on public lands affect competing and complementary investments on surrounding private lands.

I have not exhausted the list of researchable topics. But I think I have made my point. Besides, I think I have provided work for more economists than will be available in this field for several years to come.

The timber industry is currently experiencing considerable difficulty accommodating the changing public timber supply situation. I can visualize corresponding difficulties ahead regarding the supply and demand for outdoor recreation. I think the economics fraternity could contribute immensely to the resolution of a variety of natural resource problems by helping resource managers and users avoid the tyranny of small decisions emanating from a preoccupation with the extensive margins of natural resource use.

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Discussion: JAMES G. YOHO, International Paper Company

In his book, *Resource Conservation Economics and Policy*, Ciriacy-Wantrup states that the tax system has a significant and often unintended impact upon the conservation investment decisions of private owners. Jack Muench has done an excellent job in showing that a similar assertion can be made about public pressures and values. Though instituted and pushed for quite different purposes, public pressures and changing values, acting through the vehicle of public pol-

icy, are indeed having a significant and unintended impact on forest investment decisions and in turn upon future timber supply. As Muench has pointed out, one of those unintended impacts upon future timber supply is building up via *the vehicle* of federal tax policy.

There is little doubt that the ethical conservationist image of the industrial forest landowner has been damaged by the scathing attacks by preservationists upon clear cutting, large-scale use

of insecticides, and similar issues. This, in turn, will have a damaging impact upon the efforts of all forest landowners to defend Sections 631 a and b of the Internal Revenue Code when those laws are reconsidered by Congress, as they are certain to be within the next year. These laws, first enacted in 1943 as the Bailey Amendment, have, according to the testimony of the Stanford Research Institute and others, had a very stimulating effect on private investments in tree growing and thereby a very significant positive impact upon long-term timber supplies.

Despite whatever economic incentives this legislation offers, most long-term forestry activities still rank low among the competitive uses of capital within most firms using wood as a basic raw material. Moreover, all of the forest-based industries, particularly the pulp and paper industry, are suffering from a chronic low rate of return on equity and, hence, find difficulty in raising new investment capital for all purposes.¹ Accordingly, any legislative change which promises to reduce the return outlook for the industry is certain to discourage long-term investments and, hence, to have a negative influence on future timber supplies.

At International Paper we have remained optimistic that reason will ultimately prevail and Congress will see fit to avoid significantly changing the tax rules mid-way through the forestry investment game. Accordingly, our long-established policy toward forestry investments remains essentially unaltered. However, there is reason to believe that quite a few forest landowners have been sufficiently frightened by the threatened abolition of capital gains treatment for timber income to cause them to accelerate cutting schedules. We must assume, therefore, that to some extent future timber supplies have been shifted to the present.

The issue of landownership size was not touched upon by Dr. Muench, but it is particularly vulnerable to public pressures and is an important factor in the future timber supply picture. Over the past year or two, sympathies against large land holdings, particularly corporate land holdings, in step with a general antipathy toward big business, have been mounting. In the forestry sector this appears to be an outgrowth of several forces including land tax inquiries by one of Mr. Nader's groups, hearings by a

Senate Subcommittee on Migratory Labor, loose allegations by a few aspiring presidential nominees, etc.

Those generating this anti-large landowner pressure have advocated many measures to discourage and even to break up such holdings. But it has become a virtual axiom of forestry economics that encouragement of fragmented ownership is not compatible with public goals for increasing future timber supplies. History indicates that owners of small properties seldom make deliberate investments designed to step up timber growth and yield. With a similar impact on timber supply, there is reason to suspect that new small landholding migrants from urban areas, as a result of changing personal values toward the use of land, may be withdrawing significant acreages of tree-covered land from the nation's commercial forest land base.

There are, of course, other aspects of the size of ownership question which bear on national timber supply. The most significant of these is the fact that there are substantial economies of scale in nearly every aspect of forestry. Hence, public pressures which militate against the formulation or retention of large contiguous holdings of forest land tend to counter the efficiency of long-term investments in tree growth. This, in turn, pulls down the return outlook on such investments and thereby contributes to a decline in future timber supply.

Log export, primarily softwood logs from the Pacific Northwest, is another issue that has long been subjected to fluctuating pressures by preservationists, labor unions, and others. These groups have at times been quite adamant in demanding a total embargo on log exports in the interest of improving timber supply. These efforts have been at least partially successful, resulting in restrictions on exports from federal lands or in the substitution of federal timber for logs exported from private industrial lands. This whole issue is actually a very complex one which on the surface appears quite simple. When one digs into it, it is far from certain that restricting log exports will automatically increase timber supply, particularly future timber supply. It is another case where the actions of those exerting public pressure may produce unintended results.

The log exports in question have consisted largely of costly to harvest thinnings from second growth stands in a region where the domestic market is oriented primarily toward large logs produced by clear cutting from dense virgin stands. Often these export logs have provided the

¹According to *Fortune Magazine*, Pulp and Paper Companies, for example, earned only 5.6 percent on stockholders' equity in 1971, compared to 9.1 percent for its list of the top U. S. firms.

only source of income to the owners of second growth tree farms during the long and costly waiting period required for stands to reach minimum rotation age. The critical timing of this income frequently makes the difference between an acceptable and unacceptable rate of return to the tree farm owner, hence, making his investment in the nation's future timber supply possible.

There is also reason to believe that totally restricting log exports could have other adverse financial impacts upon the forest-based industry and thereby impair its ability to invest in future timber supplies. For example, the sale of export logs often leverages the sale of export chips which contribute substantially to the profits of the industry in the Northwest. Unable to import logs and forced instead to import lumber or plywood, our overseas customers would surely seek out the best package deal for lumber, plywood, and chips. I doubt if they would find the best package deal in the U. S.

In closing I would like to reemphasize the fact that long-term investments in timber growing are requisite to increasing future timber supplies. Because of the relatively high capital requirements, low rates of return and long payback periods associated with such investments, when viewed as totally new ventures, they rank significantly below average on the scale of attractiveness in the capital markets. *Stable public policy encouragements are an absolute necessity to offset this disadvantage if private investment is to make a substantial positive impact on future timber supplies.* Pressure groups seeking restrictions or pursuing other ends and irresponsible critiques, though not successful in bringing about legislative change, often add an element of uncertainty which is quite damaging to the return outlook on forest investments. They thereby often unwittingly exert a significant negative influence on future timber supply.

Seminar Session 4.0

FOREST RESOURCE POLICY AND MANAGEMENT

Subsession 4.1—Environmental Pressure on Forest Resource Management

Chairman: LARRY W. TOMBAUGH,
National Science Foundation

Discussants: Casey E. Westell, Jr., Tenneco, Inc.

Paul V. Ellefson, Society of American Foresters,
"Environmental Awareness: What Effect on Forest
Management?"

William R. Bentley, University of Michigan, "Multi-
functional Planning for Timber and Environmental
Values"

Subsession 4.2—Contributed Papers

Chairman: CLYDE FASICK, FS, USDA

Papers: George Myles, FS, USDA, "Ecotones, Checker-
boards, and Economics"

Lloyd C. Irland, FS, USDA, "The National For-
ests: Alternatives for Conflict Management"

David Larsen, FS, USDA, "Explaining the Forest
Product Selling Behavior of Private Woodland Owners
Using Optimal Combinations of Ownership Character-
istics"

J. Dewel Lawrence, FS, USDA, "Inventory on Po-
tential Open-Market Timber Volumes on Lands of
Farm and Miscellaneous Private Owners"

Subsession 4.3—Contributed Papers

Chairman: WALTER C. ANDERSON, FS, USDA

Papers: Daniel I. Navon, FS, USDA, "Long Range
Planning of Public Wildlands with the Resources Al-
location Method"

Vernon L. Robinson, FS, USDA, "Policy and Man-
agement Implications of Shifts in the Softwood Lum-
ber and Stumpage Markets"

Richard L. Sandor, University of California, "In-
novation by an Exchange: A Case Study of the De-
velopment of the Plywood Futures Contract"

Oscar S. Fowler, University of Tennessee, "Heuris-
tic Simulation of Pulpwood Harvesting Systems"

John C. Meadows and Henry H. Webster, Iowa
State University, "Land-Use Planning: Development,
Methods, and Implications for Management of Forest
Resources"

Seminar Session 5.0

INSTITUTIONAL ECONOMICS

Chairman: STEPHEN C. SMITH, University of Wisconsin

Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment*

A. ALLAN SCHMID

A PROMINENT national politician has said, "The pointed heads have failed," and he is right. New programs, agencies, and rules have promised much and delivered little in changed performance. There are deep conflicts over desired performance, but better information on the connection between alternative institutions and a given performance would help lower our political frustration. Can analysis supply tested predictions of the consequences of alternative institutions with respect to the environment?

Vernon Ruttan's 1971 AAEA Presidential Address began with the assumption of unmet demand for environmental services. From theory we know that demand could exist but not be reflected through market institutions. From this we cannot deduce that any such demand necessarily exists (and, in fact, I do not see strong evidence that the majority want to alter their life style significantly). But, let us put ourselves in the role of consultant to a group of environmentalists who have asked us to suggest which institutions they should seek to serve their ends. It would indeed be tragic if those who want more fish and less steel were to spend their political capital, get the rules changed, and still receive no improved performance, thus becoming frustrated like some other groups.

Ruttan observes a link between relative food prices and induced research in agricultural technology and thus comes down hard for modification of factor and product prices to guide both resource use and technological effort [17]. He prefers that this modification be implemented by some kind of decentralized decision process. He favors pollution user charges over standards and regulation, private property rights wherever pos-

sible over the common property situation, and enlargement of the scale of the firm (or governmental authority) to manage resources to account for externalities. One gets the feeling that these are preferred more out of recognition that what exists has failed some of the environmental interest groups rather than a solid prediction that the alternative will produce a given new result when actually implemented in detail. Before we can improve our predictive powers we will need to develop further an analytical institutional economics.

Institutional Research: What Is It?

There is a parallel between production economics and a predictive institutional economics. In the same way that we explore the effect of alternative inputs for corn yield, I want here to explore the effect of alternative institutions for human behavior. Do alternative institutions make a difference?

There is a part of conventional economics that constitutes its metaphysics which I hope has no parallel here. Bastardized versions of the Pareto-better rule and the Coase rule (that property distribution makes no difference as long as there is free trade) and others are sometimes put forward as policy guidelines which claim to maximize some unobservable, mystical state called social welfare. There is now extensive literature which expose this for the metaphysics it is [11, 18]. I will not inquire which institutions maximize social welfare.

Institutions are sets of ordered relationships among people which define their rights, exposure to the rights of others, privileges, and responsibilities. I use the term *property rights* very broadly to cover the individual components of these symbolic relationships. Property rights describe the relation among people even when no tangible commodity is involved such as in the case of civil rights and the right to organize. Institutions involve a collective choice, though it need not be

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explicit. Rights structure incentives and opportunity sets as well as shape people directly. Rights allow people to take advantage of opportunities as well as create and enhance them.

Institutions are not merely organizations, agencies, or pressure groups, although these often embody systems of rights. For example, it is important to distinguish between the set of rules involved in the concept of the corporate form and a particular firm such as General Motors. Abolition of General Motors is quite different from destruction of the corporate institution.

I have adapted a basic conception from market structure research, namely, the constructs of structure, conduct, and performance. By structure I mean to identify institutional alternatives largely in kinds of property rights and their distribution, categories of which will be outlined below. Conduct refers to the behavior and actions of people, firms, and government agencies. Performance is in terms of various intermediate products and finally human life. Policy analysis requires all of these relationships. But it is useful to distinguish between the study of institutions, which is concerned with the link between institutional alternatives and behavior, and production analysis, which studies the link between behavior and final goods and services.

Consider zero population growth. It is one thing to analyze the result of ZPG on the economy in terms of income and productivity, but it is quite different to establish the connection between the alternative institutional rules that result in women having fewer babies. For example, what child-bearing behavior results from giving each woman the marketable right to bear two children? What difference does it make if the rights are initially sold to the highest bidder? The difference in side effects (e.g., marital problems or respect for law) may be the basis for choice among the alternative institutions.

Or, consider research on limiting fertilizer in agriculture. We need biological data on the relationship of fertilizer runoff and aquatic life. This can be combined with information on agricultural production and demand to indicate the effect on food prices and production location as a result of different levels of fertilizer use. This is not institutional research. One institutional alternative is a legal prohibition of fertilizer use. The question is whether this in fact will obtain the given behavior (or what *other* behavior it also will induce). Experience with liquor and pot prohibitions indicate that this institutional form does not always produce the implied behavior.

In charting performance, attention must be given not only to those immediately subject to the rules but also the whole web of related actors. Also, the subsequent behavior to avoid or modify the rules must be noted.

Analysis must not stop at the directional impacts of prohibition, taxation, or contracts but continue to the nitty-gritty level of just how each of these is specified in detail. For example, how will the fertilizer prohibition be policed? What level of government? Are the rules written in specific commodity terms (lbs. of fertilizer) or in terms of performance (actual fish life)? What is the incentive conditioning for the bureaucrats involved? Choice at this level may make more difference for actual behavior than whether we use prohibitions or markets.

A maximization or simulation model utilizing a production function with different constraints on fertilizer use is quite different from simulating a behavioral reaction to alternative institutions which influence the amount of fertilizer actually used. Most of the current policy models are incomplete because they begin with an assumed conduct and inquire of performance. This paper is directed to the relation of institutional structure to conduct.

Behavioral assumptions

Any scientist hopes that a simple behavioral postulate will go a long way. Economists tend to inquire what conduct follows if people act to their advantage in obtaining several selected ends. As Boulding notes, these are models of advantage and not behavior. Downs and Niskanen have developed models of bureaucratic behavior based on an assumption that bureaucrats try to maximize the size of their bureaus. Our satisfaction with such models does not make economists a market for the results of behavioral science research.

Our models "work" because we have asked so little of them. For example, William Niskanen [14] guesses that many bureaus do not provide their output at least cost. He assumes this because agency heads cannot personally capture any of the savings. His reform suggestion then is to reward an agency head several years after he leaves the agency with a portion of any cost saving accomplished while in office. Niskanen does not need to do any empirical research to reach his policy recommendations. The whole thing rests on a very slender behavioral premise. For example, even if the agency head wanted to capture some of the savings, the model begs the

question of the type of bureaucratic control that allows him to implement his will. The public administration literature is full of agency head frustration. The fact that neither the agency head nor Niskanen knows just what the cost is for a given quality agency output does not inhibit the policy recommendation. There is no prediction of whose ox is gored. It is all very bloodless and not very instructive for a particular interest group who wants to pick the institution that will best serve its interests.

Current models "work" because we seldom ask them to bear any instrumental burden related to program design. Gordon Tullock applauded Niskanen's theory and eagerly awaits testing. But, the questions he asks are what explains the size of bureaucracies. For example, do they grow with national income or merely as a function of time? Suppose it turns out that empirical work discovers that bureaucracies grow proportionate to income. Does that mean that we should reduce income to control bureaucracy? Such research is devoid of instrumental variables.

Man the product

There is another important aspect to our failure to utilize behavioral information. Institutions not only affect the structure of rewards as they interact with man's behavioral bents and desires, but also they shape these desires. Much of what now passes for institutional analysis has no use for data on how man is himself shaped by the character of his interpersonal relations, because analysts only conceive of research problems as how to structure costs and benefits to select and direct given human characteristics. (The Wisconsin research on impacts of foreign land tenure alternatives cannot be understood unless this impact on human beings as well as the impact on fertilizer use and crop yield can be appreciated.)

Empirical problems and varieties of questions

The varieties of empirical institutional study are similar to those of production research. They are cross-sectional (comparative) and time series analysis. Either we compare two different "treatments" which happen to exist at the same time in two areas (including cross cultural), or we observe a given situation over time as institutions change. An example of the former is Kneese's analysis of the German *genossenschaften* for regional waste management compared to the Delaware River Basin Commission [10].

An example of time series analysis is my historical study of Michigan water law [19] and

the work of Hurst [9]. Directional changes in water law were correlated with major changes in the dominant political groups' needs for water in the economy. The rights of some individuals relative to the public (other individuals) shifted back and forth significantly to affect investment behavior and resource use. My critics reply that the institutional changes merely went along with the changes in the economy and did little to cause or shape them. I can only agree that correlation does not prove causality in institutional analysis any more than in econometric price analysis. In reality it is probably an interacting system.

Perhaps the most important approach is the comparative study over time. Ciriacy-Wantrup reminds us that the real test for an institution is its ability to handle change. "Emphasis is on determining conditions for economic growth rather than on locating peaks, on avoiding dead end streets rather than computing the shortest distance and on adaptability rather than optimum adjustment" [2, p. 189]. The important thing is whether it came closer to the given conduct and performance in the face of change than did another institutional alternative, not whether it maximized output at one moment of stability. Don Kanel has noted that owning or renting a farm may not make much difference under stability but can be critical with change. We need to understand this same type of situation with respect to the environment. It has to do with whether a person has to be consulted when changes are made or whether he must try to make bids to others to stop the modification.

The great bulk of institutional analysis is composed of individual case studies. These are often regarded with contempt by my straight brethren as merely descriptive. Why they do not have similar contempt for the same collection of data by the agricultural crop reporting service is ironical. These cases are the grist for the institutional analysis mill. True, they suffer by comparison since they tend to be gathered by independent reporters on different forms. Our science awaits some of the centralized and consistent (and expensive) reporting now enjoyed by price analysts.

The dynamic complexity of institutional interactions make empirical work difficult [15]. We cannot conduct completely controlled experiments and rerun them with various treatment levels. People learn and change, and what worked in a pilot experiment may fail later. Still, I am excited by what can be found in research such as

that tied to the current negative income tax experiment. In addition, I think it may be possible to get more from after-the-fact case studies if our theory and questions asked could be more standardized.

Another variety of institutional research sets out some process criteria, and inquiry is made to see how an existing (or proposed) institution measures up. Consider the following criteria for water institutions set out by Irving Fox [6]. It should "develop the best practicable information about the options available; provide reasonable opportunity for those affected by a decision to influence . . . the final decisions; serve a range of preferences," etc. [6, p. 31]. The similarity to the purely competitive market model is striking with its emphasis on a pluralistic structure of competition. One can count options and interest groups at a public hearing just like firms and shares of markets. This can be rather bloodless. There is a weak link between the structure and conduct. Fox makes no pretenses in this direction when he says, "a program must be judged by the process through which it is decided upon rather than by some measure of the consequences of the program itself" [6].

If he is saying that the process and its direct effect on people is *one* of the outputs of an institution, I agree. However, different institutions often will meet the same process criteria but produce different environments, just as different kinds and distributions of property are consistent with pure competition but produce different levels of employment, product mix, and income distribution.

Perhaps the grandest (and most bloodless) performance criterion of all is efficiency. For example, we can use our externality notions to conceive of the need for some basin firm to internalize waste effects and to organize production, treatment, and location alternatives to minimize the cost of achieving a given stream quality. One type of study is to inquire whether the particular institution allows for internalization. Kneese and Bower say, "In England, the Ruhr and the Delaware Basin, the interrelationship between water quality and quantity have been taken into account by putting them under the authority of one agency" [10, p. 284]. While their cost minimization models are sophisticated, their institutional model is naive. *Is there any empirical evidence shown that because a single authority has the nominal power to do something that it will in fact so behave?* What about conflicts within the basin? There may be an optimum location of in-

dustry from stream quality cost point of view, but what about effect on the local property tax base?

Kneese does note that the different countries have variations in membership on their management boards. Some have direct industry representation, and others vary by the degree of local government representation. So what? How do these variations affect actual conduct? No empirical observations are offered, so we really do not know what effect the *genossenschaften* would have if imported to the Delaware. Simply checking off whether the institution has the capacity for efficient internalization and employment of all management options and how many groups sit on the governing body is nominally empirical. But the actual impact on behavior remains a mystery. Alas, much of our institutional research does not ask the important questions. We satisfy our curiosity before we get down to conflicts of interest including the biggest one of all, the contest over who gets to decide to what level of stream quality we are going to apply our cost minimization model in the first place. I do not say the above with critical smugness; I have already noted the difficulty of getting what I want.

Institutional Alternatives and Researchable Hypotheses

If we are to make empirical progress we must have a useful set of concepts and linkages. I shall note four major categories. Achievement of a given performance may require some combination of change in several categories. One of our basic institutions is private property rights exchangeable in a market. Efforts to facilitate trade by clarifying rights and by reducing transaction costs is an important area of research. A second is the redistribution of such rights. Turning to governmental transactions, we can also speak of the rules of trade and bargaining among governments—levels and agencies. And, parallel to redistribution of market rights we can also redistribute governmental rights and change the rules of administration. These will be examined in turn.

1. Facilitate private trade to remove Pareto-relevant externalities

When a man is hungry, he has only to trade something he owns for food owned by someone else. Price is a measure of the relative power of the two (what each owns and their alternatives). If something inhibits Pareto-better trade, such as nonspecification of ownership or something

which makes trade impossible or costly, we can try to remove it. Historically, we can observe how, as resources rise in value, people attempt to have themselves declared the owner (of what was once simply nature).

One possible way to lower market transaction costs is to enlarge the scale of the firm through purchase of externally affected units. This can be seen in privately developed new towns where one firm tries to capture all of the rents created by any part of the development. The effect on conduct and performance as to the quality of communities developed has been studied. Sometimes additional government help is needed to acquire large acreages from holdout (and up) owners of key parcels. Effect of the use of eminent domain for private purposes is predictable and has a long history.

Some goods have high costs of exclusion, and free rider problems prevent private market trade. Purchase and sale (charges) by public agents will be discussed below in Item 4.

The Pareto-better logic is a powerful inhibition to empirical research into the detailed consequences of trade prohibitions, because they are so undesirable in the abstract. Yet there are other dimensions to consider. Exposure to the military draft is an individual responsibility, and trade is prohibited because of its effect on the legitimation of the whole process [22].

Another consideration stems from the interrelation of market and governmental power [18]. What is the effect of allowing firms with great power in one area (e.g., public utilities) to acquire firms in another (real estate)? Can we distinguish between cost advantages of market power enhanced by political power and that derived from superior skill and knowledge?

We should not confuse the questions surrounding rights definition with the distributive question of who gets them. Too frequently, our research stops when we cleverly determine a method to appropriate and trade rights individually. For example, consider ocean fishing rights. Everyone knows that treating the ocean as a commons is destructive of the resource and that limitation of use by gear limitations creates high production costs. A common "finding" then is that marketable quotas are in order. But who gets them? Coase's logic indicates it does not make any difference for resource use as long as rights can be traded at negligible cost. This leads some to conclude "that making the better choice between two sets of property rights is a minor matter as compared to the need to establish some

set of rights" [24, p. 58]. This is not an empirical finding but a bald value judgment. Minor matter indeed! I hope scholars will not let their research agendas be constrained by this dictum.

Transaction costs for many goods and demanders will never be zero, and even when they are, people will be interested in income distribution as an institutional performance variable. For example, institutional analysis can answer the question of what difference it makes if air "ownership" is shifted from phosphate manufacturers to nearby citrus farmers. Thomas Crocker [4] found in a Florida case that income distribution, land values, and pollution emissions changed significantly as the manufacturer bought out farmers and adjusted their process, as opposed to the former case where farmers had to organize to buy out the polluter. We will not be able to predict the magnitude of these changes unless we know farmer market transactions costs which are a function of grower group size and solidarity. Alternatively, if public purchase of pollution rights is used, we will need information on the transaction cost function under alternative voting rules. Institutional analysis can utilize such behavioral data just as an agricultural production function utilizes agronomic data to construct a production cost curve.

2. Allocate and reallocate Pareto-irrelevant externalities among private parties

When the fat have all the chips, it is going to be hard for the lean to eat no matter how negligible are transaction costs. The language of our theory tends to be value loaded, because hunger in this case is Pareto-irrelevant! I believe that the country (world?) is in danger of social upheaval and that the big issue is property distribution and participation in control. This will not be solved by research which finds a way to get everything owned and traded at no cost.

Do we have a body of empirical findings to inform public decision on effects of the original and subsequent reallocation of private property rights? All valuable things now and in the future are not already owned. New items come to our attention as tastes and technology change. We should design studies to predict the consequences of alternative distributions of the vestures of *rights in new goods*. The rich will want them sold to the highest bidder (or use political power to have themselves declared the owner). If receipts for sale of our resources (electromagnetic spectrum, etc.) were distributed as dividends to everyone, it might help shore up a minimum income

(Henry George reborn!). We might study the consequences of redistribution via taxes compared to changed property rights.

There is much current criticism of the market as an institution because of observed distributive effects. Must we move to another institution entirely, or could the desired performance be achieved by redistribution of private property rights? Some markets seem to have their own dynamics for concentrating wealth, but a periodic redistribution may be preferable to non-markets which have their problems too.

If we dare study Pareto-irrelevant change, what predictions are important? There is an empirical base to the conservatism of the courts, since at some point uncertainty as to rights makes planning long-term investment impossible. Yet, the *distinction between an unconstitutional "taking" requiring compensation and a reasonable use of the police power* needs examination.

Various legislative changes in land use have been repulsed by the courts. Take, for example, commercial sign ordinances which have a tough time in the courts unless a safety hazard can be shown. The hesitation of the courts is not necessarily based on the magnitude of the values involved. Some signs have little value. Compare this with the great values involved in zoning. Everyday, millions of dollars are given to some and denied others and the courts scarcely blink an eye. It should be possible empirically to determine how much rights can change before the uncertainty affects investment of various kinds. If this were available, the courts would need to develop some systematic rationale for the great present disparities in the value of redistribution which required compensation or not. We can also trace out the consequences in different resource areas of the present distinctions.

If the courts will loosen up a bit, some innovative legislation might be possible. The competition among owners to acquire the land appreciation connected with rezoning often frustrates public land use plans. A Maryland state senator has proposed that county governments decide the total amount of land to be developed and then assign this amount as marketable rights to all present landowners proportionate to their holdings. (An alternative would be to assign it to all citizens or the county government.) A developer would not only need zoning but also the development rights. While one can theoretically trace out some of the consequences of such proposals, they have a tendency to produce some unpredicted results. Though the English trial is rele-

vant, our knowledge will be limited until we actually experiment more with these and other alternative institutions such as special land value capital gains taxes.

Of course, we could dispense with public land use planning entirely and turn to overt private plans. A study of Houston [21] suggests that private land use controls via deed restrictions can do much of what zoning does. Some of the differences in Houston and other cities are instructive and might be larger if public land use plans were actually implemented anywhere.

Courts and legislatures also make a curious *distinction between technological and pecuniary externalities*. If I keep pigs on my residential area lot, the courts tend to enjoin without compensation. But, if a competitor destroys the value of my property by creation of a cheaper product, no one hears my cry of anguish. Our cavalier attitude is shaped by theory which suggests that it is for the good of the consumer and all resources are mobile anyway, and if these owners are smart, they can move without loss. So, when the government invested in cotton irrigation in the Southwest and destroyed fixed assets in the old South, no court stood in the way. Some of the consequences are becoming clear [8, Ch. 6]. More research is needed on the effects of pecuniary externalities. They may be the source of many unintended grants (transfers) from the poor to the rich.

Powerful firms and unions seldom take pecuniary externalities lying down. Research should be directed to the net costs if these losses were publicly shared rather than borne in featherbedding and the like. A case in point is the unemployment effects of pollution controls and plant closings. Do employees have job rights, and what difference does the institution chosen for their protection make to third parties?

To conclude this portion I can do no better than Joan Robinson who says, "We have not got a theory of distribution" [16, p. 9]. We never will have until we understand the impact of property institutions.

3. Facilitate governmental trade

The fact that governments and their agencies trade as do private parties has led to a rash of imperialistic advances of economists into public administration. The issues here parallel those in private trade of making rights clear, reducing transaction costs, and enlarging the scale of the firm (agency).

An example of lack of clarity in ownership

rights can be seen in the issue of massive interbasin water transfer. Currently, states bargain with each other in terms of getting their share of the federal water development budget in exchange for political cooperation in transfers. If rights were clearer and marketable, the water-rich Northwest might sell its rights and use the money for education and hospitals rather than more federal water projects. If the dry states had to buy the water directly, they might not take so much.

There are those who believe that private ownership is always superior to public when there is no exclusion problem. Armen Alchian hypothesizes that "the differences between public and private ownership arise from the inability of a public owner to sell his share of public ownership . . ." [1, p. 822]. This is not unrelated to Niskanen's suggestion that agency heads should be able to appropriate some of their potential agency cost savings. Empirical studies have been made of the performance of stock vs. mutual savings and loan associations [13]. Other work comparing public and private golf courses and utilities might be productive if performance variables include not only profit differences but also technological change, employment of minorities, and environmental impact.

The required environmental impact statements in the National Environmental Policy Act (NEPA) go a long way to reduce transaction costs between some people and government. Groups which found it expensive to organize and obtain information now have it handed to them. One major impact of NEPA is that its procedural and informational requirements are subject to court review upon citizen complaint. Research might establish the consequences if rules for water development benefit cost analysis were subject to court review. It might make the agencies take more seriously some of the provisions in the new Water Resources Council principles and standards. Rights of citizen recourse in the face of administrative decisions are keys in affecting behavior.

We are in an era of symbolic worship of *inter-governmental cooperation*. I say symbolic because while many urge it, we do little to set forth the rules for this interaction. In the private market there are elaborate rules for fair trade and what one can do to get agreement to a contract. The NEPA informational requirements are one of the few areas where fraud in public agency bargaining is defined. There are few publicly established rules governing the bargaining

within the Water Resources Council or any of its river basin commissions. The situation seems no better around the world, for Craine's English study reports, "Apparently little attention has been given to the rules by which River Authorities arrive at decisions" [3, p. 116]. The law does not even say whether majority rule or unanimity is required.

This lack is also prevalent when governments buy public services from each other. Contract purchase by independent cities can achieve economies of scale without requiring political consolidation [23]. While studies have been made of the Lakewood plan in the Los Angeles area, the lack of public rules governing these contracts gives us little empirical knowledge of the consequences of alternatives. The available studies are not conclusive in comparing the results of the Dade County consolidation and the Los Angeles contract system.

People seem to choose sides in support of organizational reform largely in terms of the institution's own internal truth and beauty rather than knowledge of substantive performance. This is no less true of local government than federal resource agency consolidation. Supporters of a given proposal often are strange bedfellows, which suggests that support is based on poor prediction of effects. (I have summarized the limited knowledge of reorganization effects of the water agencies elsewhere [20].)

4. Allocate and reallocate Pareto-irrelevant externalities among publics

Though resource giveaways have been the primary historical method of reallocating publicly owned property rights, they are not the only device. Every time the government changes its administration rules for the use of public resources, it changes the access of different individuals as surely as if private rights were confiscated (reallocated).

What kind of rights does a given group have in existing public regulatory rules or use and lease of public property (including charges)? If somebody damages my canoe, I can sue, but if motorcycles are allowed to spoil my use of a publicly owned park, I typically have no court claim. Research is needed on the consequences of this and the possibility for interpreting administrative rules as property rights which the courts will protect. This is especially critical over time, as taste and technology change. The classic environmental battle has been between the "bad" private industrial polluter and the "good" public fisher-

men. But the second generation problem will involve conflict among public users such as fishermen and boaters.

Voting rules.—Perhaps the most basic reallocations of public rights involve constitutional rights when representation on various public bodies is established. Ed Haefele [7] has summarized some of the theoretical research on voting rules and applied it to environmental issues. For selected cases it is possible to predict how certain voting rules (e.g., number of seats and number of votes per person) affect which alternative policy wins, given a postulated distribution of preferences. This is similar to that game theory where, if you know the behavior of others, your best strategy can be calculated. This is suggestive theory, but it is not empirical research. For prediction, we need knowledge of the actual distribution of preferences and behavior (not to mention all the variables involved in the effect of different formulations of the issues and control of the agenda). Thus, we are a long way from being able to advise a particular interest group of what rules it should support to maximize its preference realization.

Haefele does suggest some of the possible effects of having river basin quality control commission members selected by election rather than appointed by the governor. There must be a host of variations of this type in resource management institutions which might yield important insight. Our old normative rules are of little help. Democracy is our political equivalent of the free market, but it does not help us decide boundary questions for voting. Since normative theory is of no help, let us get on with empirical work and see what difference alternative bases for representation really make, so people can intelligently make their own moral choice of who is their brother.

These are the institutional decisions which determine the actual stream quality level that our cost minimization models are applied to. J. H. Dales, one of the early proponents of a water control board to determine water quality and to issue quotas for discharge that can be traded, made this question clear when he said, "Being largely ignorant of the principles of public administration, I shall side-step the important questions of how many Board members there should be, how long each should serve, and what their qualifications should be" [5, pp. 77-78]. No institutional economics worthy of the name can sidestep these issues.

In summary, the rules of access to government, administrative procedure, bargaining within and

between governments (and with the public) can be thought of as property rights. They constitute an important part of each individual's wealth holding. We need to inquire of the consequences if they were granted the same access to the courts for their protection as are individual property rights.

Conclusions

We must be careful not to become obsessed with the size of the goods pile (or the number of whooping cranes) but keep our eye on man, the final product. While some argue that nature has rights too, nature is silent when men speak in its name. Institutions shape the goods which shape men, and they also directly affect men. At least since Marx, we should understand that institutions which define human interrelationships directly affect the character of man. The need for behavioral data to link institutions to actual conduct should be clear. We need theories of behavior and not just advantage.

While I have little confidence in our current institutional predictive ability in many areas and for many behavioral consequences, I am relatively confident that major change in the environment calls for major change in institutions. We have fooled people into thinking that a bit more enforcement or another commission or consolidated agency will make a difference. I am not sure the majority really want a big change in their life style, but if they do, a bit more zoning and regulation will not do it. It will require major changes in property definition and distribution and careful attention to the details of implementation and administration.

The mythology of welfare economics which has barred research interest in some institutional questions (e.g., pecuniary externality and Pareto-irrelevancies) has been cleared away (often for the *n*th time). We do have some concepts for categorizing alternative institutions relating people to each other as they manage resources and create new technology and people. Let us not get hung up on weighting the various performance effects but rather concentrate on predicting their variety and distribution.

The four classes of institutional relationships outlined above have alternatives within, and the mix among classes is also variable. It is tough to separate out the effect of variation in private property definition, but it may be downright maddening to trace the synergistic effects of various combinations of private and public administrative

rules and the details of implementation. Yet this is our challenge if we are to be able to supply warranted predictions of the consequences of alternative institutions. Gunnar Myrdal says, "I believe that the next ten or fifteen years will see a radical redirection of our research efforts towards institutional economics . . . focusing on the

equality issue and taking into due account social and economic stratification, the political forces anchored in these institutions and in peoples' attitudes, and the productivity consequences . . ." [12, p. 459]. If this becomes a reality, we shall have to solve some of the tough empirical, experimental problems noted here.

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Discussion: DAVID J. ALLEE, Cornell University

Schmid is right. Many of the prescriptions for institutional change which are based upon economic analysis are like suggestions from checkers being offered to the chess champion. He explains why quite well when he points out that it is incomplete to study the links between conduct and performance, leaving out the links between structure and conduct. It may be even worse than Schmid has space to make clear. You cannot write a textbook in a paper. He sweeps aside some problems that will not stay swept away—and he knows it. Also, there may be some bright

spots down the tunnel that he could not display for us. This paper will try to complicate what he has made too simple and point to at least one kind of analysis that he does not have room to explore.

Normatively, economists have been concerned with analytics that provide answers to what goods and services the citizens would choose if they were really able to express their preferences. Here the focus is upon the arrangements to make those decisions which citizens would prefer if they were able to express their preferences.

Perhaps Schmid is working a bit too hard at the pedagogic analogy between production economics and institutional economics. Many of his readers and listeners may find the analogy comfortable and thus be more easily convinced. He may also feel that he has to destroy seductive normative approaches before his easily seduced brethren will take behavioral studies seriously. I agree that behavioral findings are a fundamental and largely lacking prerequisite to useful normative work, but there is some overkill here.

An early overkill item is one that I am prone to use and thus can recognize. "Bastardized versions of the Pareto-better rule and the Coase rule . . ." put forward in the name of some " . . . unobservable, mystical state called social welfare" is metaphysics. "The mythology of welfare economics" has kept many of us from asking the right questions; indeed, we have aided and abetted the rape of some natural resources because, while we helped perfect a benefit-cost analysis, we ignored the real distributional consequences of the development at hand. But perhaps we need just the kind of studies that Schmid calls for before we can logically throw out this metaphysics. We can reject it on rational grounds, e.g., redistribution with compensation is not transitive, but that is just the kind of test that is not enough. This metaphysics is part of the structure of some environmental management problems. The conduct and performance with and without this metaphysics are not well understood. My impression is the same as Schmid's; I expect the weight of the evidence when studied to be that, in general, it has cost us more than it has gained us. At least one generation of engineer-planners has failed to ask meaningful distributional questions because they were lulled by welfare rationale for benefit-cost analysis that equated national income accounts with what Schmid later calls the quality of life.

This is related to the problem of measuring performance. It is a question of how institutions shape men, condition their lives by providing and restricting opportunities, etc. Man is the product, and it is his behavior we must judge if we are to judge institutions. That is a role most of us have trouble accepting because of its godlike character, although this does not keep us from seeing it in the posture taken by others. I think this is what Fox is getting at when he puts forward process criteria for water institutions, the point being that because you are not likely to get agreement about how to measure performance of a program in terms of output, then perhaps we

reach agreement on " . . . the process through which it is decided upon. . . ." Part of that process is who gets to participate and to what degree. As Schmid observes, " . . . who gets to decide what level of stream quality we are going to apply our cost minimization model to . . ." may have much more to do with the outcome than how good the model is. Indeed, this illustrates one of the major points at issue with our "straight brethren." Let's ask the institutional questions that may have more efficiency implications than the efficiency questions.

Schmid's four major categories give him a chance to group some of his excellent observations of where work needs to be done, but I expect that we will continue to specialize by problem area and institutional form. Perhaps in time they will turn out to be useful delineations for specialization in the field, but that is not the point. The greater usefulness of these groupings is to keep someone from feeling that because he has answered a point in one category that he can freely ignore the others when he makes a policy recommendation. The categories do not pretend to mutual excludability. The expectation is that most economists would stop at facilitating private and governmental trade and not go on to related redistribution questions. This may be because of the difficulty of measuring performance. It is not clear how Schmid expects us to ease our guilt feelings about making judgments of who should lose and who should gain. At least he does not hide behind income classes as proxies for everything or say that the problem can be side-stepped by displaying the income effects of groups and letting the mystical decision maker decide. Maybe we just have to accept the fact that we are participants in the change process and have a role to play.

We know that it is an incremental world, but Schmid, like most of us, clearly wishes it were not so. Lindblom, Dahl, Wildavsky, and many others have characterized the policy process as incremental and interactive. You really do not get the chance to implement any particular structural model. But this does not mean it is not useful to describe one that may be more than an incremental change from what exists. The point is that the advice which the environmental groups or any others need is not just identification of "major changes in property definition and distribution," but rather strategic concepts which can be applied to incremental shift after incremental shift. It is by broadening their participation through whatever structural changes develop that their

goals and values will be served by that structure. Any proposal for structural change will influence the men that it affects and they will influence it. The outcome may eventually be predictable but probably still enough in doubt that it would not be efficient to design round two until the results from round one are starting to come in.

Interestingly enough, it is only in recent years that political scientists seem to be turning their attention to policy studies. One group is quite behavioral in its orientation and is well represented on this program by Helen Ingram's seminar paper on basin arrangements. The questions asked are essentially these: Who affects decisions and how? What rewards and penalties are offered for involvement? Where in the structure are the key decision points for each participant? How are consent-building relations established? And how and why are each of these changing? This is the base which you need to do effective normative analysis. The real territory for viable change is defined. You can meaningfully ask, "What should we do now?"

This has been attempted over the years for the water development field and recently pulled together based on a model by Ingram [1]. I look forward to more exploration of the normative constructs that now can be more effectively applied to the field. Water development is a locally based issue and this conditions the way agencies, the Congress, and the President are structured and behave. Basin plans are not plans but trial balloons. States are sometimes participants. Mutual accommodation between projects forms a major basis for a national program. Agencies with their structure and discipline, traditions,

and rewards are the most obvious participants. Less obvious but almost as important to the outcome are local activists. But the rewards for local participation are changing. Shifts in national and local participation by environmental interests mean that well-developed conflict management mechanisms (including engineering feasibility, benefit-cost analysis and local cost sharing, multiple-purpose project formulation techniques) are under increasing stress. Opportunities exist for new roles for state agencies and regional arrangements that broaden the basis for bargaining and that involve rewards for gubernatorial participation to replace congressional roles. Also, the potential for new missions for old agencies is very real. What to do? Choices of which changes to support can be made based upon who appears to be benefited and who hurt by a change and picking sides. Most of us will follow that route if we try to affect the choices.

The "public choice school" offers an interesting potential to improve such choices if the use of its tools is based upon the kind of behavioral base sketched above. Schmid refers to Gordon Tullock but cannot do the group justice.¹ Their grand approach is based upon familiar grounds. Rationality, maximization, self-interest, levels of risk and uncertainty, and the nature of public goods and services provide a basis for further reasoning. But much of that reasoning to date has been based upon very little in the way of field-developed behavioral assumptions. Schmid and I have met in the field. I, too, look forward to seeing you there.

¹For a survey of much of the relevant literature, see [2].

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Discussion: WILLIAM E. MARTIN, University of Arizona

In 1969 James Shaffer [5] wrote the paper, "On Institutional Obsolescence and Innovation—Background for Professional Dialogue on Public Policy." Contributed papers commenting on this base paper were requested from the profession at large, and both the base paper and the comments

were presented at the Lexington, Kentucky, meetings.

In this paper Shaffer made a plea for "much greater involvement of applied social scientists in the process of public policy formation. Effective public policy . . . depends upon organizing our

institutions to direct the system to achieve desired goals rather than accept whatever pattern of organization evolves. An essential input into the system is organized intellectual effort directed at institution innovation" [5, p. 246].

Two of my colleagues and I [2] commented on Shaffer's paper to the effect that his "comments on institutional obsolescence and innovation are cogent and particularly relevant to the times!" But we had to conclude that his plea would have little effect on the members of our profession in terms of encouraging them, at the end of a research effort, to make a concrete proposal for action or even to make a reasonably strong statement of policy implications.

In the same year at the Western Agricultural Economics meetings, Kelso and Hillman [1] asked that we "demand critical appraisal of existing institutions in order to devise better ones. . . ."

At that time the interest in institutional criticism and innovation was directed mostly toward the failure and obsolescence of institutions in agriculture. Two years later the sociocultural climate of the nation had shifted significantly toward recognition of widespread environmental degradation throughout the economy. Ruttan, in his presidential address before this group of "agricultural" economists, turned to issues in "Technology and the Environment" [3] in a general sense rather than in the more limited discussions of technology and obsolescence of institutions in the rural environs. Ruttan suggested, "Institutional systems must be sought that are capable of internalizing incentives for environmental management." His suggestions were the impetus leading to the current paper under discussion, "Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment."

Now, three years after the plea from Shaffer, we find Schmid making another excellent plea for the study of institutions for the express purpose of making policy recommendations. Schmid focuses on a crucial and wildly emotional issue, the institution of property rights, with property rights defined in their broadest fashion to include all the "*ordered relationships among people which define their rights, exposure to the rights of others, privileges and responsibilities*" (italics in the original).

As with our comments of three years ago, I can only say that I "agree with his analysis and description right down the line." I especially applaud Schmid's interest in investigating and in-

terpreting Pareto-irrelevant problems as well as Pareto-better issues. (The problems may be irrelevant to Pareto, but not to the great majority of people in our rather unequal society.) However, just as three years ago, I do not hope for much action relative to Schmid's analysis and proposals.

My discouragement does not arise so much from the difficulty of making relevant and competent studies of institutional alternatives—certainly, the analytical difficulties are formidable—but rather in the attitudes of the members of our profession toward making positive statements at the end of their research effort. It has proven hard enough for us in our profession to state strong implications relative to our work in issues of limited scope amenable to rigorous empirical analysis. I am afraid that for many of us selecting a Pareto-irrelevant situation to study, much less making a positive judgment of our own work at the study's conclusion, will be too much for our rather sensitive psyches to handle.

These observations are based on a fairly detailed and wide review of what was apparently the best literature that our profession has had to offer in the period since 1969 when my colleagues and I first made similar comments. During that time, I have been privileged to serve for two years on the AAEA committee to select the "best published research" and have also had the privilege of serving for one year on the editorial council of our *Journal*. The editorial council selects the "outstanding article" in the *AJAE*. Thus, I have had to read everything in the *Journal* and those other published works which were considered worthy by their respective authors.

Without detracting from the excellence displayed by the winning research, I can say that the great majority of articles and monographs failed to impress me. Almost all were competent, scholarly efforts; but only a few researchers had selected topics of wide social interest and then felt strongly enough about their results to make recommendations based on the implications of their work. There were a few notable exceptions, and I'm proud to say that one of these, the Schmitz and Seckler [4] article, "Mechanized Agriculture and Social Welfare: The Case of the Tomato Harvester," was selected as the outstanding article in the *Journal* for 1970, indicating that one can obtain *professional* recognition while sticking one's neck out.

If we are to attack important problems in institutional economics, as Schmid suggests, we cannot avoid sticking our neck into controversial

issues. Controversy is what property rights are all about. The number of Pareto-better questions left to study may still be quite large, but they are almost always intertwined with Pareto-irrelevant issues so that value judgments must be made at certain points within the analysis itself.

Further, once we have selected an issue for study and have given the issue the best analysis of which we are capable, at some point we must draw a usable conclusion. Why publish a piece of research if the results are so inconclusive that even the researchers do not have a strong opinion about the usefulness of the results? Such inconclusive conclusions appeared at the end of our "best" research more times than I wish to remember.

Some of the problems of dabbling in controversy must have been subconsciously bothering Schmid as he was writing his paper. His paper is nominally about environmental research. In his conclusion he states, "I am relatively confident that major change in the environment calls for major change in institutions. We have fooled people into thinking that a bit more enforcement or another commission or consolidated agency will make a difference. *I am not sure the majority really want a big change in their life style*, but if they do, a bit more zoning and regulation will not do it. It will require major changes in property definition and distribution and careful attention to the de-

tails of implementation" (my emphasis).

In his introduction, he states that, "... we cannot deduce that any such demand [for environmental services] necessarily exists (and in fact I do not see strong evidence that the majority want to alter their life style significantly. But, let us put ourselves in the role of consultant to a group of environmentalists who have asked us to suggest which institutions they should seek to serve their ends."

In other words, the demand for institutional alternatives is still so small (or hidden) that in order even to think about the problem we must act as private consultants to an individual pressure group rather than in our normal role as public consultants to the public. The problem is that the public apparently does not have an environmental goal for which to select alternative institutions. The public goal of economic growth is inherently in opposition to the environmentalist goal. As Schmid says, "There is a parallel between production economics and predictive institutional economics." I agree. But until we have an overall economic goal to work with that is consistent with production of environmental services (perhaps minimum cost for a given output), selection of alternative environmental institutions will be somewhat futile exercise for which no market really exists.

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Discussion: JOSEPH W. LITTLE, University of Florida

At the outset I would commend a reading of Professor Schmid's paper to all who have been lulled into believing that the environmental situation is augering well because of institutional upheavals created by current environmental hue and cry. Much pro-forms institutional change has occurred and I will address myself to a brief

description of some of it shortly. But, Professor Schmid warns us, we do not know and indeed do not have the necessary tools to predict what ultimate achievements will be made toward attaining satisfaction of some quite vague notions of environmental quality so earnestly striven for by many of us.

In reading Professor Schmid's paper, I was struck by his facility in shaking the reader free of any smugly held notions about the state of where we stand in predicting and evaluating performance of our institutions. He brings such a welter of ideas to bear on his point that it is difficult to criticize the whole in a short statement. Nevertheless, I will make brief remarks about three notions that impressed me as being peculiarly useful and worthy of general comment and further study. Following that, I will make more detailed comment on various institutional changes presently occurring in laws affecting the environment. My purpose is to indicate several possibilities that may be opening up in comparative institutional research in environmental matters.

I sense that what we are ultimately studying in institutional research is regulation of the individual behavior of a large number of specific human beings. Since I left lawyering as a profession and entered legal teaching and research as my preferred occupation, the fact that that is also what the law is all about has made itself clear to me. In fact, on the highest conceptual level, the behavioral sciences, the law, economics, and many other disciplines all are toiling away at a common goal—understanding and regulating human behavior—but all from different directions and too often with no coordination and sometimes with outright antagonism. Through all this an even more fundamental issue appears to be emerging. Even if we could predict with certainty the effects of designated institutional changes on ultimate modes of human behavior, I detect a growing sense of apprehension and hesitance in specifying which modes of behavior we should program our institutions to produce. Philosopher kings could rule on what is right without bothering themselves as to the impact on the people. What was right was right, no matter how many people suffered! But the era of the philosopher kings is being supplanted by the democratic kingdom of the common man—well educated under mass education standards, worldly in his knowledge, and personally affluent by historical standards. Hence, confident consensus of what is right human behavior will be harder and harder to reach. This dilemma is presently manifest in environmental controversies, just as it is in political conventions, and will grow in importance as our tools of prediction are honed finer.

A second factor which merits comment is the thought that we rarely evaluate institutional changes save on anecdotal and intuitive bases.

That these sorts of evaluation can be misleading is plain to anyone who has seriously examined the details of any institution in operation. That we as a people invest or shift great fortunes through never-evaluated legislative institutional changes is probably not perceived by most of the people of this country. Professor Schmid alludes to the shifting of cotton production from the South to the Southwest largely through public development of irrigation systems. More recent examples include sweeping changes we in Florida have rendered in three of our fundamental legal institutions during 1971 and 1972. We adopted the most radical no-fault automobile insurance law yet created in any state; we adopted a no-fault divorce law; and we gained the right to vote for our 18-year-olds. Aside from a very small grant made by a private foundation (The Council on Law-Related Studies of Cambridge, Mass.) to study the impact of no-fault insurance, I know of no provision made to evaluate the effects of these changes on ultimate modes of human behavior, despite the fact that each represents a drastic departure from long-established cultural norms.

This criticism is not to be aimed only at Florida. Earlier this month I participated in a highway safety law seminar in Boulder, Colorado, in which motor vehicle administrators were strongly criticized for never having evaluated long-standing safety programs. The same criticism could be made of virtually every legislative program yet implemented. I do not know precisely how evaluation should be achieved, but I do believe legislatures should make monies available. In no instance, however, should evaluation be placed in the hands of either a program's advocates or its administrators. After we have learned to evaluate, then we will be in better posture to predict, which, as Professor Schmid observes, we presently do poorly or not at all.

Third, Professor Schmid begins to develop a concept of property as a concomitant of administrative rules for allocating public resources among competing "publics." I do not know to what extent economic theory has incorporated this concept, nor can I give a learned discourse on what the law has done, but I can report that legal theories are fast developing in this field. Interestingly enough, Charles Reich of *Greening of America* fame first gained considerable stature in the world of legal scholarship through his 1964 essay entitled "The New Property" [7]. It appears upon cursory review that the new property concept has been pushed furthest in law suits

involving welfare and employment rights (akin to tenure cases), but it certainly pertains to environmental rights and may prove to have its greatest applicability there. Certainly, if we as a people evolve a basic right to a healthful environment, that future will be assured. (But, then, we really will be stuck in deciding what is a "healthful environment.")

Putting aside those general observations, I will now indicate the varying kinds of environmental institutional experiments presently being tried out in this country. No attempt will be made to be comprehensive; none of the programs will be examined in detail beyond that necessary to demonstrate basic institutional differences. First are regulatory programs represented on the federal level by the Clean Air Act [1] and the Federal Water Pollution Control Act [10]. These programs are expected to achieve designated levels of environmental quality through adherence to specified anti-pollution standards for air and water cleanliness. Supposedly, meeting standards will stimulate investment in anti-pollution devices in a manner that will satisfactorily distribute costs to beneficiaries of the programs. I am aware that many traditional economists do not find favor with this approach and would prefer to make cleanliness of air and water an item of barter between those who would befoul them and the public [4,8]. I have no particular quarrel with those who prefer the latter method, but I would like to see a careful evaluation of each phase of the existing programs before they are scrapped.

The National Environmental *Policy* Act (NEPA) represents a second approach, and I emphasized the word *Policy* because many people, including Professor Schmid, erroneously use the word *Protection* in its place. The difference is no mere semantic quibble. To have a definite policy that the environment is to be protected is one thing; but simply to have a national policy on environmental matters is quite another. It is the latter that we have—a national policy on environmental matters. Although NEPA contains predicated language in favor of a healthful environment and some federal courts have apparently inferred that NEPA imposes an affirmative protective policy [3], the binding thrust of NEPA, as written, is purely procedural: the impact of major federal activities on the quality of the human environment must be considered in decision-making processes. It is conceivable, therefore, that federal agencies will continue to make exactly the same decisions as they would have made without NEPA, except at much greater

cost and with longer delays. The possibilities would be somewhat different if federal law imposed environmental protection as an affirmative goal in each proposed activity.

A third sort of institution would be one that is actually imbued with the policy erroneously attributed to NEPA: that is, an affirmative policy to protect the environment. So far as I am aware, the people of Florida expressed the clearest statement of that position yet enacted into law when they added the following provision to the state's constitution: "It shall be the policy of the state to conserve and protect its natural resources and scenic beauty" [2]. Whether that constitutional policy will lead us to a sensible environmental practice remains to be seen, but some signs of encouragement can be found [5]. The Florida Supreme Court has given the measure substantive meaning in one case [9], and the Florida Legislature followed up with innovative land and water management laws in 1972. Whether or not this protective policy approach will control the powerful forces whose first interest is economic gain is clearly unsettled in Florida.

In closing I will propose an environmental policy experiment that may get a reaction from economic theoreticians, particularly those interested in transportation. As you know, the totality of the transportation industry, including automobile makers, petroleum companies, truckers, railroads, etc., is huge, making up 20 to 25 percent of the country's gross national product. As you probably also know, one of the major agents implicated in environmentally abusive actions is highway transportation. Highway building frequently destroys the natural environment and disrupts the social fabric of our communities, while use of the internal combustion engine poisons the air, and vehicles of all sorts create offensive noises. Presently, federal gasoline taxes and other highway user taxes and fees feed several billions of dollars per year into a highway trust fund. Matched by either equal amounts or $\frac{1}{6}$ th amounts of state monies, the highway trust fund has created a tremendous system of interstate and other federal aid highways. All this began in 1916 with the passage of the first federal aid highway act. According to numerous critics, joined most recently by Lewis Mumford [6], this giant fund has led to road building mania; to demise of public transportation, particularly railroads; and to almost total social reliance on the private automobile.

These artifacts with their aura of independence and progress are all to the good until

streets and highways become congested, and road building blitzes historical and environmental preservation, clean air, and other competing social values. The worm may now be turning. The arrogant automobile may have exacted too high a price. A growing body of opinion holds that the unwholesome aspects of highway transportation must be reversed, and many critics call for weaning away our dependence on private automobiles by employing the highway trust fund to build mass transit systems. But the enormously powerful highway lobby finds weakness in that position and insists that users of the highways have built the highways and should not be forced to subsidize mass transit. In seeking Congressional authorization to expend a fraction of trust fund monies for mass transit, the present administration tries for only part of a loaf. Even if obtained, highway builders will continue to make private transportation more attractive with more and better roads, which is what started this cycle in the first place.

No current program or proposal is drastic enough to supplant preference for private automobiles with a preference for mass transportation. To remedy this, I call for a new set of institutional goals and a new institutional *modus operandi* in transportation policy. First, let us de-

vote all highway trust fund monies for the next five years to mass transit while stopping all federal aid to highways. Simultaneously, let us place new user taxes on all modes of public transportation, freight handling, etc., and pour them into a mass transit fund. As the mass transit fund grows, part of the money will be siphoned off into a highway trust sinking fund and the remainder will build mass transit systems. Coupling no new highways and deteriorating old ones with better modes of mass transit will force users to switch their preference to the new system, thereby swelling the coffers of the mass transit fund and making even better systems available. Finally, the day will come again when mass transit is a viable economic enterprise. At that time the highway transit sinking fund can be released to repay the original donation from highway taxes, and needed new highways will be built. At the same time new highway user taxes can be imposed at a level selected to create a state of equilibrium between mass transit and private transportation, giving us an environmentally and socially sensible set of transportation alternatives. If we then evaluate the impacts of those institutions on human behavior and find them satisfactory, we may then all live happily ever after.

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Seminar 5.0

INSTITUTIONAL ECONOMICS

Subsession 5.1—Policy Issues of Large-Scale Organization, Corporate, Labor, and Governmental, Upon Land Resources and Community Development

Chairman: MARION CLAWSON,
Resources for the Future, Inc.

Discussants: Willard F. Mueller, University of Wisconsin, "Impact of Changing Industrial Organization on Community Development"

Louis Weschler and Robert Warren, Center for

Urban Affairs, University of Southern California, "Boundary Problems in Land Use Decisions"

Subsession 5.2—Evaluating Water Resources Institutions: Their Political Viability and Economic and Administrative Performance

Chairman: FRANK H. BOLLMAN,
National Water Commission

Discussants: Helen Ingram, University of Arizona, "The Political Viability of Regional Water Institutions"

Joe B. Stevens, Oregon State University, "Outcome and Process Criteria for Normative Appraisals of Water Institutions"

Subsession 5.3—Institutional Innovation for Community and Regional Waste Management

Chairman: PAUL N. BARKLEY,
Washington State University

Discussants: Daniel W. Bromley, University of Wisconsin, "Institutional Innovations for Community and Regional Waste Management"

James A. Seagraves, North Carolina State University, "Induced Institutional Innovations for the Environment"

Subsession 5.4—Contributed Papers

Chairman: JOHN REYNOLDS, University of Florida

Papers: Thomas L. Dobbs, Carl E. Olson, W. Gary Wedemeyer, and George H. Pfeiffer, University of Wyoming, "Financing Private Water Resource Development: Analysis of a State Loan Program"

George D. Irwin, ERS, USDA, "A Rural Credit Gap: Dollars and/or Semantics?"

Russell L. Berry, South Dakota State University, "Farm Tenure Goals and Adversive Share Tenancy Controls"

Harold W. Lough and Richard F. Fallert, ERS, USDA, "Supply Control—An Extension of the Institutionalized Fluid Milk Marketing System"

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Sectional Meeting D*

ANALYTICAL METHODS IN
AGRICULTURAL ECONOMICS

Chairman: JOHN P. DOLL, University of Missouri

Paper: George G. Judge, University of Illinois, "Estimation—The Use of Regression and Simultaneous Equation Techniques"

Discussant: Richard J. Foote, Texas Tech University
Paper: Richard H. Day, University of Wisconsin, "Optimization—The Use of Linear Programings and Related Techniques"

Discussant: Verner G. Hurt, Mississippi State University
Paper: Stanley R. Johnson, University of Missouri, and Gordon C. Rausser, University of California, Davis, "Simulation—The Use of Simulation, Systems Analysis, and Related Techniques"

Discussant: Oscar R. Burt, Montana State University

* Sectional Meeting D papers will be published in the *Post-War Literature Review*.

Sectional Meeting E
CONTINUING EDUCATION IN THE 1970'S

Chairman: KENNETH R. FARRELL, ERS, USDA

Clientele for Continuing Education in the 1970's

B. F. STANTON

THIS paper is not very academic. Neither is the topic. It is very popular these days to challenge the establishment, and such challenges should be welcomed even if some of the questions are aimed in our direction. The land grant system provides an interesting target. Despite its recent origins, that is, recent by European standards, it is the largest, best supported, and most highly regarded system of higher education in the world. So it can afford to be challenged by Mr. Hightower, Mr. Nader, and anyone else who wishes, including us. In fact, if it is to continue as the best public education system in the world, it must constantly innovate, evaluate, and accept change and challenge.

Mr. Hightower and the "Accountability" project [1] are in good company with their challenge. Throughout their little book, which has evoked varying responses in agricultural colleges, Cooperative Extension, and the U.S. Department of Agriculture, they quote those within the system who are also asking questions. The call for public accountability is as American as apple pie. And we all should participate in it. Many of us think the land grant system has been held accountable for a long time. Substantial effort has been spent trying to keep track of those accounts. But perhaps that effort has too often been directed toward other establishment groups, hence the mixed reaction and response to the "Accountability" project's generally uncomplimentary and demeaning attack on the institutions in which most of us take so much pride.

The topic for this session was proposed before most of us knew there was an "accountability" project. I have given this slashing bit of current journalism more space than it probably deserves. But the coincidence is impressive. The challenge for change in our continuing education programs should be coming from within the system. And it has been, but we have not given it the priority it

deserves. Read "A People and A Spirit" [3] prepared by professionals within Cooperative Extension. It is not a call for the status quo. Listen to commercial farmers, county agents, and representatives in county government. They are far from smug and self-satisfied about their adult education programs. Hear Quentin West's recent statement [5] to the Directors of State Agricultural Experiment Stations:

There are termites in the foundation of our ivory tower. We need to climb down and get our feet on the ground where the action is. When our agricultural research system was established 50 years or more ago, it was focused on the most pressing national problems. We had our feet on the ground then. But these problems have changed. Has our research mechanism kept pace so that it continues to focus on national priorities?

There is awareness by people within the system that we can do better. There are prods from outside to get on with the job. There are people who are willing to make the effort. The question still remains, "What should be done first and how?" Some might even ask, "Are we sure we know what we need to do?" This session is intended to encourage discussion of this kind of question. Hopefully, it will lead to action and not merely more talk.

Clientele

Who are the prime audiences or clientele toward whom the agricultural part of the land grant system should be directing its efforts in continuing education? It would be easy to produce a laundry list of groups—some more traditional than others—but all familiar enough so that most everyone present would have similar ideas. But the basis for making such lists deserves more than passing comments. Perhaps this is where one burst of creative energy should be expended.

Who should benefit from continuing or adult education programs concerned with the food and

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fiber industry, natural resources, and rural development? Is it commercial farmers, farm workers, rural resource owners, cooperatives, processors, food manufacturers, food retailers, government officials, college professors, or extension workers? I suppose the answer is, YES, everyone. No special groups should benefit at the expense of some other. That is easy to say and believe as a principle. In practice we have been concerned first with farmers, agricultural resource owners, and the businesses that supply them and buy from them. In recent decades we have identified new groups, expanded our horizons, seen a larger role with more and more people.

But, to get back to the central issue—who should benefit from public education? Consumers, producers, and the general public—that's a stock answer. Or is it? Who has benefited most from the substantial public resources committed to research, teaching, and extension by the agricultural colleges of the land grant system? The honest answer supported by impressive documentation is *the consumer of food and agricultural fiber*. It is clear that the avowed purpose of some of that effort has been to expand farm income, to decrease rural poverty, to speed adjustment of the disadvantaged producer. Some research and public policy has clearly tried to maintain or improve the incomes of some producing groups at the expense of other sectors of the economy or the public generally. The special case of public policy and price supports for tung nuts and tung oil can be mentioned without much political rancor. The case of sugar touches more people and more interests. It remains as good an example as any of a policy that persists despite its obvious costs to the rest of our society. D. Gale Johnson has spoken to these issues recently and much more effectively than I [2]. Happily, most of our public efforts have had a very different impact over time.

Most of us take pride in the fact that American consumers continue to spend a declining share of their disposable income on food. Today that share is 15 to 17 percent, depending on how you make the calculations. In 1960, the comparable number was 20 percent. In 1950, it was 22 and in 1940, it was 25 percent [4]. Food is still the most important item in the household budget. The American housewife does not take these expenditures for granted as the National Price Commission clearly recognizes. Who will lose if the proportion of income allocated to buy food and the services that go with it starts to rise? We all will in our role as consumers. Those with the

lowest incomes will be hardest hit, a fact that our nation will not accept as wise or in the public interest.

Consumers and the Public Interest

It surely sounds as if I am dragging out all the old clichés and the obvious, politically acceptable statements to argue that retail consumers of food and fiber products should provide a central focus for our efforts in continuing education in the 1970's. And despite disclaimers to the contrary, that would be quite a switch. The historic mandate has been the other way around. Orientation of adult education programs has been to producers at every level in the food and fiber system. First, it was to farmers; then, to and through input suppliers; next, in a variety of ways to marketing organizations, processors, fabricators. And now with considerable hesitation and concern there is some orientation of programs to retailers and their employees where products meet the public.

The justification for this emphasis was twofold. First, farmers and rural people did not have the private resources or the means to provide their own research and establish a way to put research results into practice. The bulk were, and still are, disadvantaged in terms of income relative to the average American. The second reason was even more compelling. The resulting gains in efficiency from the applications of publicly supported research and extension were so widespread over large numbers that they could not be maintained for long to the advantage of the few. The economic and social system passed them on to the benefit of all, hence the declining shares of disposable income required to buy food.

What would really happen if we put first priority in bright lights on continuing education directed toward the American consumer? Obviously, I do not know. But it would lead to some interesting changes in rhetoric, I am sure. To begin with, the central issue for many of us would be national food policy. The other central policy issue around which our profession would have major concern would be the *use of natural resources*. In a different context and in keeping with the jargon of current politics, this might be called *rural resource development*.

In such a setting, farm policy would be divided into two parts. One part would center on the use of land, water, and natural resources for farming and other productive enterprises. Emphasis would be placed in the larger context of developing and wisely using our natural and human re-

sources in "rural" America. The second part would be on food policy with a conscious and direct focus on consumer as well as producer concerns. The orientation would have a substantially different cast, although the work of many agricultural economists has really been turned in this direction for a long time.

Can you conceive of the United States Department of Agriculture taking on the title of Department of Food and Natural Resources? Some departments of agricultural economics now call themselves "food economics" or "resource economics" departments. So this suggestion is not such a novel one after all, at least not in principle. But, in practice it might well be something else. After all, who are the consumers and the consumer lobby? They vote regularly in supermarkets, fast food outlets, and the incredible array of places where we all expect to find something to eat 24 hours a day. But as a constituency they are a pretty amorphous lot. They are not likely to go to the legislature to support my budget or yours. They seem more likely to complain about what is wrong with the land grant system long before they provide support for what is right. As a focus for continuing education, you may nod in agreement but then dismiss these comments as just another impractical suggestion produced by a confused, part-time administrator from an over-crowded urban state.

A National Food Policy

But let us pursue continuing education and food policy with a consumer orientation for just a few more minutes. Do we or should we have a national food policy? Clearly we have some pieces of one now. What is the school lunch program? Is it just a way of getting rid of surplus farm commodities to maintain farm prices at the expense of consumers and the public treasury? What portion of the school lunch program today is directed toward the nutritional needs of children and the desire to provide an improved environment for learning? And what about the 40-year old, much modified food stamp program, born in the days of national depression? How can or should such a program be integrated into a more comprehensive view of public assistance, the negative income tax, and a free-choice consumer economy? What is the role of the Food and Drug Administration? And what about the substantial inspection, grading, and registry functions of food products carried out by the federal and state departments of agriculture?

Again, it is easier to ask questions than answer

them. I would say we have parts of a national program directed primarily toward concerns for consumer welfare and the continuing delivery of a wide variety of foods to all people in a form and condition that is safe and wholesome. In a way, it is strange that our profession and the political process have not provided greater focus on the elements of a national food policy. Some already exist. Why not work toward a synthesis which takes a comprehensive view of the role of the public sector in the production and distribution of food where producer and consumer are acknowledged from the outset to have equal emphasis?

Let us assume that the consumer and his concerns about food, the system that provides it, and its availability to his fellow citizens is one of the prime targets for the efforts of agricultural economists in continuing education in the 1970's. What difference, if any, will that make? Much depends on the spirit within which this prime target is approached. After years of interaction with producers at all levels in the food industry, an open shift toward consumer issues in our public education programs might well create some mixed reactions. Consumer groups might well wonder if such a shift were not a carefully disguised mechanism to serve producer welfare. Producers might decry even more vigorously that colleges of agriculture had forgotten their mandate to serve farmers, agriculture, and the food industry. *The underlying thesis of this paper is that producers and consumer interests for the food industry must be the same.* In the short run consumers naturally want to pay "less" for porterhouse steaks, pork chops, fresh baked rolls, head lettuce, and frozen cherry pie. Producers at each stage in the chain of production want to receive a large share of the consumer's dollar for their services. It almost sounds incongruous that producer and consumer interests for the food industry should be the same. Conflict seems much more natural. Perhaps this is the chief challenge to face in designing education programs in the 1970's and 1980's.

Concentration in the Food Industry

Whether or not you accept the basic notion that consumer and producer interests for the food industry in the long run must converge, most should agree with a few general observations about the food industry and the markets it serves. National and multistate or regional markets have become dominant in most sectors of the industry. Important regional or local preferences

for food and food products still exist. But national brands, mass markets, and the giants of the communications media dominate public opinion on everything from cranberries to tuna fish. While all of us pride ourselves on our independence and freedom to make choices, we almost unconsciously buy the current cereal pushed on television because the kids demand it.

Despite all the rhetoric expressing concern about concentration, the number of producers in input supply, at the farm, in processing, assembly and manufacture, and at retail continues to decline. Concentration continues. Yet the evidence of true monopoly or monopsony power in any of these sectors is hard to trace over time. Not that individual groups, including farmers and processors, have not tried to obtain such power. The short-run gains always seem very real but remain illusory. It is hard to learn from our history—whether it be Sappiro's quest of producer cooperative control of farm prices in the 1920's, or the Embassy Dairy case in the 1950's, or retail price fixing sought by state legislative mandate in the 1960's. All failed for one reason or another. And our system must make sure they continue to fail.

In this and succeeding decades further concentration of power in the hands of fewer large organizations, cooperatives, or corporations within the food industry is likely. All kinds of experimentation with various kinds of relationships between these large and powerful groups are likely. Some will seek to gain control by outright purchase of their suppliers on one side and their sales outlets on the other. But simply gaining control of a part of the market does not solve basic technical or economic problems. I have watched apple producers borrow capital to buy a processing plant that closed under private management. After their own heroic efforts to manage a technically inferior plant that was too small and poorly located, they, too, closed their doors poorer and wiser. A few large corporations have discovered that farming does take some management ability as well as capital and have returned the farm land they bought to full-time farmers. The other side of the coin always gets more publicity. The bonanza of leasing tax-loss cattle created much more interest among my beef cattle friends in animal science than the demise of Bermeac Industries a few years later. Currently some food retailers have moved into egg production. Greyhound is in the meat business from slaughter through transport to the final consumer served at a fast food outlet. Feed manufacturers

are still producing chicken and pork either directly or indirectly through a controlled contract system. Profit margins remain narrow because freedom of entry and exit in production has been maintained.

Consumers have a substantial stake in the structure and development of the food industry. So do farm producers. So do the workers and resource owners of cooperatives, corporations, and proprietorships at every level in the industry. All are among the audiences toward which public education programs should be directed. These are the groups who will influence in one manner or another how industry structure changes, how efficiently the sectors within the industry perform, how well public policy functions as an instrument in the public interest.

Continuing education should be based on scholarship and research. Most will agree with this basic tenet of the land grant system. One can still ask many questions about the best approach to develop priorities and establish programs for effective teaching and learning. Should we try to design programs that seek to reach simultaneously all of the audiences concerned with the food industry? Or, should we put first emphasis on reaching the individual special interest groups within the system with special programs that concentrate on the focus of their concerns? We have usually been most successful when we have taken the second approach. Carefully developed programs for a defined audience provide greater opportunity for continuing interaction with clients and greater knowledge of existing levels of understanding of issues or technical information. The teaching situation is more direct and personal. For example, teaching programs for farmers and lenders of agricultural credit have more often been separate than joint. It was not because they could not learn from each other and together, but because their initial needs and perceptions were different. Some efforts have been made now to include both groups in one teaching situation. Should not more of these experiments be followed?

At the risk of stepping into discussion of delivery systems and research needs for continuing education, the following assertion is put forward. More, rather than less effort must be placed in bringing the special interest groups within the food industry together for adult education. Members of the different groups should be involved in the teaching. Greater effort in preparing teaching materials will be required. Greater risks will be involved. But, the potential benefits may be well

worth the incremental costs. This is not to push aside old and successful teaching programs. They should be continued and improved. We need to recognize, nevertheless, that the numbers of participants from each of the subsectors in the food industry may be decreasing. One professional might well be more effective by cutting across state boundaries with an excellent program rather than the familiar practice of duplicating his efforts and teaching materials in a second state with a less qualified educator.

On the one hand we argue for greater specialization of teaching resources with the opportunity to cut across the old political subdivisions to reach special interest groups with focused programs. On the other hand we argue for a new effort to reach consumer leaders, government officials and administrators, and the general public with general education programs.

In recent months food prices, particularly those for retail cuts of meat, have been big news. What a great opportunity we have had to meet the public and explain the "whys" of prices. The record in most states will show an honest effort by many agricultural economists to tell the story with news releases, printed leaflets, signed articles, radio broadcasts, and an occasional TV appearance. But, the *Today* show did not look to the land grant system or the USDA for an interview in June. It went to the American Meat Institute and the National Association of Food Chains. One wonders if some of our most able professional economists should not spend some energy getting acquainted with the major networks and the national press and wire services. Agricultural economists from the land grant system are welcome visitors in nearly all the trade associations, cooperatives, and major corporations at every level in the food industry. If we are as objective and concerned about the "public interest" as we say we are, who should be able to do a better job in talking to someone like Edwin Dale of the *New York Times* or Barbara Walters at NBC? Only a few of us have the combination of talent, knowledge, and credibility to do these jobs.

In a world of mass media, national markets and educational emphasis, national food policy deserves national effort. What about NET and the food industry? We've all enjoyed the fun of *Sesame Street*. Could we provide an honest and exciting picture of the food industry starting with the input supplier and the farmer and following the processes all the way to fast food outlet and the consumer if we tried? It could be fun! There could be a real opportunity for all the

conflict within the system to be explored with a live cast of characters. We could expose our success stories and the bottlenecks. We could help people see the many sides to structural problems. But, there could be no hint of hiding reality or protecting those who feel vulnerable. It should not and could not be the captive of some interest group in the system.

Most of the space in this presentation has been used to talk about food policy and the food industry. In the next decade an increasing amount of energy and effort will be directed to facing the problems of rural development, land use planning, and decisions with respect to the use of our natural resources. Agricultural economists and the land grant system have great opportunity and responsibility to meet the challenges and needs both for research and public education in these areas. The clientele are somewhat analogous to those identified for the food industry. But the proportions are clearly different. So is our historical base.

Elected and appointed officials of government at every level will be one of our key audiences. The delicate working relationships which extension workers and land grant educators have learned to establish with many units of government must be enhanced. The art of keeping channels of communication open with quite divergent special interest groups is no less important here than in the food industry. Public sector decision making on natural resource issues will make impossible demands on our system for objective information. The land grant system and Cooperative Extension are better prepared than any other public institution to meet these rapidly escalating needs. And we must continue to reallocate our professional resources accordingly.

It is easier to make suggestions than to take actions. Our organizations and performance have been challenged from both within and without. We need to respond by keeping the best of what we have, taking pride in past accomplishment while facing new challenge. In this decade our land grant system in its programs of continuing education should:

- (1) Identify consumers, consumer groups, and the public sector as a significant focus for public education programs concerning the food industry.

- (2) Take a leadership role in bringing about greater communication between the special interest groups within the food industry and the consumer groups who make the final purchase decisions and determine in part the environment

within which production occurs.

(3) Deemphasize farm policy as a basis for public discussion and concentrate on national food policy on the one hand and rural resource development issues on the other.

(4) Recognize the substantial number of professionals in government and regulatory agencies as a key group to whom continuing education and research results should be extended.

(5) Make efforts to remove the constraints imposed by county and state political boundaries in devising and developing teaching programs. Markets and audiences cross these boundaries without concern. Mechanisms to allow educational programs to flow equally easily are necessary.

(6) Determine whether regional or national efforts to use television are feasible to carry on adult education programs on policy issues such as rural development, natural resource planning, and the structure of the food industry.

(7) Increase the emphasis already being given to sequential teaching programs with all types of audiences and clientele groups.

(8) Maintain an objective posture on public issues by insuring that alternative points of view are presented effectively and consistently. The luxury of *advocacy* positions on policy issues is not consistent with continuing efforts in public education.

(9) Continue to establish and maintain working relationships and thereby understanding of the problems and changes occurring in each of the sectors of the food industry, the public sectors concerned with the industry, and consumer groups concerned with policy issues.

(10) Find ways to use our professional resources in continuing education more effectively (1) to take advantage of new techniques and the media, (2) to serve larger geographical areas with the same number of individuals, and (3) to reallocate staff as new priorities are recognized.

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Delivery Systems for Continuing Education

LEE R. KOLMER

THIS paper, like the preceding one, is, in my judgment, very academic. In fact, we might say that this entire section of the program is a very important subject for academia today. Today's environment calls on us to develop a new sophistication, a broader program that will tax the discipline and provide an expanding opportunity to serve society.

Today we, like every other discipline in the university, are being challenged. We are being challenged as to our reason for being. We are being asked the question, are you useful? Are you worth our tax dollars? Are we, as taxpayers, getting a product that is valuable to us as we work through the institutional and personal changes that are associated with a rapidly changing society?

We are being challenged from many sources because we have assisted one segment of rural America but have virtually ignored another segment. We have been eager to help in building an efficient agriculture, but we have not been as eager to work with those rural Americans who are not sharing proportionally in the wealth of the nation, economically, socially, or culturally. We have not given this problem the recognition it merits in our research and extension programs.

The statistics suggest that this recognition is long past due. Today per capita outlays for social services are three to four times greater in urban areas than in rural areas; non-metropolitan counties account for two-thirds of the substandard housing but receive one-sixth of the federal funds; and non-metropolitan counties have one-half of the children in disadvantaged circumstances but only receive 20 to 41 percent of the monies allocated to programs concerned with such children.

This situation represents a great challenge to the land grant university. While the university is not the sole cause for this condition, it must accept an educational responsibility for providing assistance in the future.

The questions and the challenge must be answered and, in my judgment, can be answered very positively and effectively. The questions can

be answered within our present framework in the land grant university.

However, I believe we must examine our output as we attempt to answer the challenge. To be effective our output must contain knowledge which can be used by the decision makers on a day-to-day basis. To be used it must be understood, and to be understood it must be placed in a framework and in a language that has meaning to the recipient. To be useful this product must be conveyed to the public in a way that makes it relatively easy for the potential user to participate in the educational process. These two conditions cannot be met unless we as extension and research staff members have an intimate knowledge of the needs and desires of a wide array of people who are affected by the economic decisions and policies of this society.

If we are to convey knowledge to the public, we must have a delivery system. Within the land grant system we are, of course, referring to the Cooperative Extension Service or University Extension, depending upon how your individual university is organized. The delivery system represents more than just a series of offices out across the state. A delivery system, to be really effective, is tied closely to the research component so that the three items mentioned above (a valuable output, a method of conveyance to the public, and knowledge of the needs and desires of the people) become an integral part of the total process of research and extension within the department and the university.

Delivery System Characteristics

If we are to have an effective delivery system for continuing education in the 70's, it must have certain attributes. It must be accessible to the citizens of the state and the nation, accessible in the sense of being close by and convenient so that the citizens can obtain the output of the university without incurring unreasonable expense in terms of time or money. It must be accessible so that the citizen can make contact to register his concerns, to make his suggestions as to future needs, and to become a part of the total planning, researching, and extending process that can materially affect his social and economic welfare.

An effective delivery system must also have the capacity to deliver an objective, unbiased program. This objectivity is critical for the welfare

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of the audience, the extender, and the researcher. The acceptance of the total output of the land grant university is materially affected by the creditability of the extending system attached to that land grant university.

The delivery system must be flexible and responsive, flexible to the extent that it evolves as the issues, the problems, and the opportunities for education evolve in the communities it serves. It must have the capacity to respond to unforeseen needs at the local level. It must be responsive to the extent that it provides a place for the citizen to register his concern or need and thereby submit these problem areas for consideration by extension and research staff as they plan future work. It must be responsive in the sense that it recognizes that the problems facing the individual and the community are the problems that they consider as high priority problems to be worked on, rather than solely working on problems that interest, stimulate, and intrigue the individual extension or research worker.

The system must also be accountable; accountable to the local citizen through the county court, Extension Council, or whatever group has responsibility for local support of the extension office; accountable to the state and national governments that contribute to its support; accountable to the professionals who are involved in the system; accountable in the sense that it maintains the unbiased, objective educational function over time and produces a high quality of output that is understandable and usable by the audiences it serves.

If such a framework did not now exist, I feel that we would have to invent one. We would have to invent one if we are to realize the goals set forth by this society. We are fortunate that the framework does now exist in the form of the county offices, specialist staff, research staff, local advisory committees, and the formal linkage for financial support and program influence between the university and local governing bodies and between the university and the national government.

This tripartite system for continuing education has been in existence a long time, and it is not perfect. But, it is present and can be improved substantially by the manner in which it is used by the subject matter disciplines within the university. Agricultural economists have been involved with this system for many years. We all know of the traditional inputs into this system and the impact these inputs have had upon the agriculture of this nation. The farm management,

commodity marketing, agricultural policy, and community development inputs have long been important components of the extension education program. Sometimes we have been effective as we have developed and conducted research and extension programs and sometimes we have not been effective. We have diverse opinions within our profession as to the value and usefulness of this system: some of us feel that it is very valuable and very useful; others feel that it is not very valuable and that it is a second-rate operation conducted by the university.

There are also varying opinions held by the users and potential users of the product of agricultural economics as it comes through this delivery system. Again, some people hold the contribution of agricultural economics in high esteem, while others feel that the best efforts of agricultural economics have not gone into the programs emanating from this delivery system. I mention this to point up the fact that while this framework is present, it is not always effective. The usefulness of the delivery system will depend upon the attitudes and inputs of the professionals as well as the attitudes of the audience as each views the delivery system and attempts to make use of it as a conveyor or as a source of educational programs.

Subject Matter Areas

Dr. Stanton's paper emphasizes food policy and some of the possible conflicts and opportunities that are present as we attempt to move from an area of agricultural policy with emphasis on production to a total food policy for the nation. I feel this is a very important part of the responsibility of agricultural economics, but it is only part of the responsibility. I believe that agricultural economics with its intimate involvement and knowledge of a wide spectrum of issues and problems facing both the rural and urban society can offer much more to the citizens of this country. I believe their continuing concern for tax policy as it affects the entire population should be exploited and used to provide the subject matter base for objective and realistic continuing education programs, programs which present alternatives to the citizen as they look at the revenue needs and the sources of revenue for financing local, state, and national tax-supported programs. The wealth of experience and knowledge in the management of small firms as represented by commercial agriculture provides a very substantial base for management education relating to the management of small firms on main street.

The intimate knowledge that agricultural economists have of the problems and processes that management must undertake in a small firm is much too useful in today's competitive economy to be confined to the management of commercial farm enterprises.

The traditional commodity marketing program in agricultural economics provides a sound base for expansion of this program to areas concerned with organizational structure and decision making within the framework of coordinated marketing systems. Collective bargaining for price, organizational structures which will permit effective control and improved systems for internal communication, and decision making are needed by producers, handlers, processors, and the consumers of agricultural products.

The recognition that social and economic development must proceed on a wide front if we are to have a balanced economy and society brings in a very real need for the talents of the agricultural economist. The economic analysis of the costs and returns of all the inputs that are involved in the development process presents a real challenge to agricultural economists. It also provides opportunity for agricultural economists to join forces with other social scientists in presenting a rather complete analysis of the social and economic considerations and in making intelligent decisions at the ballot box and in their roles as community leaders. Agricultural economists have for many years been involved in all of these areas of concern and I believe in the future must continue to be involved on a broad front. My plea is that we think broader than just food policy or the production and marketing of food products.

Staff Involvement and Commitment

Irrespective of how we view the role of our profession in continuing education, the development of the subject matter, important as it is, is only a part of the product. The method that is used to convey this product is also important. A rigorously developed journal article usually does not catch fire in a county commissioner's office or at a meeting in the community building or with the administrator of a state agency or with the membership of a commodity organization. The logic and the concepts that the journal article contains may catch fire and be very useful to the audiences mentioned *if* it is presented in a manner that is comprehensible and fitted to the environment in which the individual must use it. It is therefore very important that we not only have knowledge but also that we have a method

of presenting it so that it can be translated into action. Extension is, in fact, "education for action" and to maintain this philosophy we must structure our information in a way that will permit the user to convert the ideas into decisions and therefore action. The argument can be made that this is the job of the specialist and the field staff; the researcher turns the product over to the specialist and he in turn translates the research into comprehensible language and conveys it to the people. I agree that the specialist has responsibility for this, but I am also convinced that research staff must be involved in this process or there will be conflict.

One resource that we often neglect as we look at the challenge of conveying economic information from the research staff through the specialist to the people is the local agent or extension staff member. The local staff can be of great assistance in teaching economic subject matter. County staff are not interchangeable with specialists, but if they are involved in the development of the material and are trained, field staff will provide an important additional resource in teaching that can very well make the difference between success and failure. It does not always require an economist to carry an economic message. The basic economic concepts and messages that we are trying to convey can often be very effectively taught by the agricultural agent, family living agent, or the 4-H and youth agent in the setting in which they are working. This integration of economic ideas with other technical and social service concepts makes our state educational effort more effective.

We have been discussing economic subject matter up to now. But if we view the needs of the citizen who is presumably seeking knowledge to convert into action, we must recognize that economic subject matter is always applied to a particular problem that has physical and technical input relating to other disciplines. The cliché that "people have problems and universities have departments" recognizes that most of our problems have components that cross discipline lines. If the delivery system for continuing education must take discreet outputs from the several departments of the university and present them to the potential user for him to assimilate and assemble as best he can, we are doomed to failure. The combination of economics, technical agriculture, food science, the disciplines within home economics and the school of business, and other social sciences are all ingredients for our continuing education efforts. Not all of the subject mat-

ter needs are contained within the College of Agriculture. Effective program building across the subject matter front requires professional discipline, compromise, and a certain humility. This involvement with other disciplines to develop and present a cohesive body of knowledge is deemed to be too slow and time consuming by many people, but the fact that it presents more usable and useful knowledge to the participants results in this process being the most efficient means of developing and conveying such information.

Economists have gained—rightly or wrongly—some reputation for being aloof and inflexible among our colleagues in the university. For the most part, this reputation has not disturbed us; in some cases we rather gloried in having such a reputation. More recently we have been concerned. We have been concerned about our lack of involvement in instances where important program decisions were being discussed by other professional and program leaders. This concern is, in my mind, healthy and provides an opportunity for us to reexamine our role and attitude and to become more effective in the development of educational programs that contain social, economic, and physical science components.

This reputation for aloofness and disdain for the mundane problems facing people is not confined to our university colleagues. A farmer with an advanced degree in agricultural economics commented, "Agricultural economists seem to be in orbit. When do you think they will come down to earth and be concerned with the real problems people have?" Another made the statement, "Those economists are always telling us why it won't work when my accounts prove to me that it does."

This says to me that we are not doing a good job of setting our economic information in the environment in which it will be used. We are missing some of the important relationships which materially affect the final decision. If we recognize and accept the input of the other social and physical sciences involved and have the philosophy that agricultural economics is one of the disciplines involved in the solution of problems, then we will have an end product that will be used by the specific audience we are addressing. This recognition that we are one of several disciplines that have contributions to make is a part of the responsiveness and flexibility of a delivery system and a research program as it attempts to relate to the needs of the audience it serves.

Relating to our audiences is often difficult. Be-

ing responsive and attempting to direct efforts toward significant problems of people means that we must listen to people. We must listen to people and assist them in placing priorities on problems. Listening and setting priorities by ourselves is not nearly as useful, even though the priorities may be correct, because the output will not have as receptive an audience as is the case if the people with the problems are a part of the development of the program.

Audiences

What is our audience? What audience should we seek for this delivery system for continuing education in the 1970's? Dr. Stanton has laid out his views as to an important portion of this audience. He argues, very persuasively, that we need to concern ourselves more with the interests and concerns of the consumers of this nation. I concur with Dr. Stanton in this regard. The management of resources by consumers is a very real area of concern. We have not done much in the area in the past; we could even argue that we have almost abdicated our responsibility in this area. What contributions have agricultural economists made in this area? We have made some, but our record is very spotty. We must, however, recognize that effective educational programs with consumers can very materially reduce our public expenditures for welfare, the costs of family bankruptcy, both to the individual and society, and the general well-being of American families. Agricultural economists, with their background in microeconomics and the family firm, can offer much in this area if we decide that the consumer's management of resources is an important area of work.

Public policy education as it relates to consumers is another major area of concern. Dr. Stanton points this out very vividly as he discusses the implications of a food policy program that embraces both the producer and the consumer as an audience. This same analysis can be extended to other areas of public policy and issues that concern the environment where a very real choice must be made, in some instances, between continued economic growth and an improvement in the physical environment. This issue will become increasingly important as consumers and government agencies wrestle with the choice between jobs and improvement of the environment. As public employees we sometimes feel that the public is in open revolt in terms of levels and taxation policy. This again provides an opportunity for conveying to the consumer the

alternatives regarding the level of service desired and the level of revenue available as they think through the alternatives prior to casting their vote.

Both the economics of environmental improvement and the taxation issues are part and parcel of the continuing effort to develop rural communities across the nation. Agricultural economists with their knowledge of farm production and marketing, their access to the leadership in communities, and their commitment to rural America offer a very real resource for educational programs in community development. However, to be effective the agricultural economists must, and do, recognize the complex and often bewildering combinations of issues that are involved in community development. This complexity does provide an opportunity for agricultural economists to demonstrate that sophisticated research techniques can be extremely useful and are a necessity in the down-to-earth decision-making process involved in community development. This challenge can be one of the most far-reaching uses of our expertise during the next decade.

The rapid growth of local and state government during recent years places government in a more prominent position as one of the audiences of the research and extension efforts of agricultural economists. Government has always been part of our audience, but today a new combination of agencies is represented in this audience. Welfare agencies are a part of this audience. The impact of continuing education on future welfare costs is a very real opportunity for economic education in the future. The expanded Food and Nutrition Program which the USDA has launched through the Extension Service is an example of this conviction that the welfare costs of the future can be reduced by making an investment in education in the present. The contracts between the Departments of Human Resources in state government and Extension Service that provide for training for welfare recipients in obtaining and keeping a job is a recognition that educational inputs can be used to reduce welfare costs. If training in the fundamentals of management of personal and family resources is included, the impact upon the lives of the recipient and upon the public welfare role can be very significant.

The migrant laborer and the displaced farm family represents another audience for the agricultural economist in the decade ahead. The needs and concerns of this now unneeded labor have not been a part of our analysis very often in the past. We have recognized the needs of the

producer as he attempts to substitute capital for labor. We have not, however, given similar attention to the alternatives available for the migrant laborer and the displaced farm family and the implications the increased rate of mechanization has upon the rural economy and the national society.

Analysis of the alternatives that face the migrant laborer and displaced farmer under present conditions and an educational program that will help assess these alternatives could be one of our more significant contributions to American society in the coming years. Some beginnings have been made in this area. The Rural Area Manpower Development program conducted in concert with the Department of Employment and the U.S. Department of Labor is a small beginning in this direction. This program recognizes that the rural resident who does not have local opportunity for employment can better be served by working with him at home prior to moving to a metropolitan area. Agricultural economists can make a substantial input in this endeavor.

We have often been disturbed by the seeming economic illiteracy of the American society. We have been disturbed, but what have we done about it? What efforts have we made as agricultural economists to make a significant input into the economic education of the people of this nation? What efforts have we made to develop programs which will provide a beginning for improved understanding of the economic processes for community leaders and for community decision makers? I think that there is need for a substantial program to improve the individual citizen's understanding of the impact of economic growth upon a community, a program which does not make judgments but which does point out the alternative impacts of different levels of growth upon a local society.

The Total Product

Up to now we have discussed the product of agricultural economics and the method that can be used to convey this product to different audiences. Now there is need to discuss the means of putting the product and the method together to have an effective program.

Development of a total package that is comprehensible and useful to the audience means much involvement throughout the process. The involvement of local advisory groups or local citizens with the extension and research staff prior to the onset of a major research and educational effort is very important. Involvement of the spe-

cialist with the field staff and the research staff to maintain the level of coordination needed and to facilitate communication between the different groups is a critical problem for effective education. We are talking about a team—the field staff member, the specialist, and the research staff—a team focused on developing a product that is useful to the recipient and on making those adjustments and using those methods that will ensure, to the greatest degree possible, such use. This means judgments as to what information is critical, selecting such information, and using methods that will convey the idea most clearly and succinctly. This will many times result in using information and methods which are relatively unsophisticated but which fit the environment of the audience and therefore are most useful at this point in time.

This brings us back to attitude. To do this requires a certain humility on the part of all concerned. It requires an acceptance of each of the team members as a professional. It requires that we submerge our personal and professional desires to the larger task of developing programs that meet the needs of the audience rather than meeting our own personal or professional desires.

It means reexamining our reason for being, reexamining the reason why the taxpayers are supporting our program. It means that we must recognize that to be useful we must be used, we must be used as teachers of students on campus, as researchers seeking new knowledge, and as extension staff extending this knowledge to our off-campus audience. It means accepting each part of the land grant system as an equal partner in this task. This is an old problem, and yet it is also a new problem. It is an old problem because the extension, research, and teaching components have been a part of the land grant system for a long time. It is a new problem because new demands are being made of us and new questions are being asked of us by different audiences. It is a very real and significant challenge for this discipline and every other discipline on the land grant campus. At the same time it is what we are paid to do, and what we are expected to do by the citizens that we serve. We have the research capacity to accomplish this task, we have a variety of audiences for our efforts, and we have a delivery system to bring our information to our audiences. The essential ingredients are available. We can do it if we want to do it.

Research Support for Continuing Education

LUDWIG M. EISCRUBER

The Challenge to Research

Research and continuing education

It may not be possible to state the relationship between research and continuing education better and more sharply than to quote B. F. Stanton [14]: "Continuing education should be based on scholarship and research." Stanton, in his paper, develops a logical basis for this statement. In addition, his statement is supported (at least indirectly) by empirical evidence [9, 16] which seems to indicate that continuing education and research go hand in hand in improving farm income and in increasing returns to human capital. Empirical evidence in Table 1 also is such that the hypothesis, "continuing education should be based on scholarship and research," cannot be rejected.¹ What this table shows is that extension education efforts are distributed over the various problem areas similar to that of research efforts, although the so-called "people problems" seem to receive more attention by extension than they do by research. Thus, in addition to supporting the contention that continuing education be based on research and scholarship, Table 1 also suggests that particularly in the "people-oriented" problem areas, continuing education may tend to lead research. Understanding that continuing education can direct research to significant problems should be of particular importance to the social scientist. On the other hand, it should be understood that a good researcher in any discipline will often anticipate important problems before they are recognized by the public. Thus, the challenge for research lies in appropriately assessing the signals received from continuing education and balancing them against research interests generated by research staff.

¹Table 1 shows professional man-years for the Cooperative Extension Service only. To be sure, continuing education is carried out by other organizations and agencies, both public and private. However, the Cooperative Extension Service is clearly the most important continuing education organization for our profession, regardless of how "relevance" of the profession is defined, as long as it is defined realistically. An analogous statement holds true for research.

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Total research mission

It is necessary to point out that the total mission of research is considerably broader than the support of continuing education. While support of continuing education may be a very important—maybe even the most important—dimension, it is not the only research dimension. This is true regardless of whether we consider public or privately financed research, and it is true regardless of whether we consider public or private research organizations, both of which may work with either public or private funds. Other dimensions of the total research mission, particularly in publicly funded universities, include the support of classroom teaching. In addition, in more recent years we could observe a trend on the part of publicly funded research agencies toward accepting projects or contracts of an action-oriented, problem-solving nature. Such contracts may involve the establishment of educational research institutions (both here and abroad), the execution of feasibility studies (e.g., river basin development, plant location), the assistance with planning in ministries of commerce, agriculture, and education, etc. Still another dimension is the execution of contract research for either private or public organizations where the intended use of the research results is within the contract letting agency.

This list of different dimensions of the total research mission is not intended to be exhaustive (the role of basic research has not even been mentioned!), but it is sufficient to make the point that continuing education is not the only client to research. To be sure, important relationships and varying degrees of complementarity exist between the various research dimensions and continuing education. However, not all research has as its goal the support of continuing education. The discussion below must be viewed in this light rather than as a comprehensive discussion of research needs.

The scope of the research establishment

In this paper we shall confine our attention primarily to the research behavior and research output of universities (both public and private) and government research agencies. Currently, these are the primary sources of research support for continuing education, and they appear to re-

main the primary source in the foreseeable future. However, certain changes taking place in the research environment indicate the possibility that other sources of research support may become more important in the future, perhaps considerably more important.

The changing research environment

Many environmental factors which affect the research environment and, indeed, the entire profession of agricultural economists have changed during the past decade. These are effectively presented elsewhere [e.g., 2] and need not be repeated here. However, one of these factors has received little or no attention by agricultural economist. Yet this particular factor appears to be of crucial importance to the relationship between research and continuing education as well as to the success of much advocated multidisciplinary research. This argument is most persuasively presented by Robert Nisbet in his book, *The Degradation of the Academic Dogma: The University in America, 1945-1970* [12]. He argues that our affluent, technological, postindustrial society can do without a university. What it cannot do without is ever continuing discovery and constant diffusion of knowledge to future generations. However, so argues Nisbet, society

will find other ways of getting this done unless the universities rid themselves of most of their project and contract research and return their professors to the status of the Chaucerian scholar and teacher. It would be easy to dismiss this thesis as trivial, but that would amount to looking the other way in the hope the problem will then disappear. There are at least three different groups in our society who support Nisbet's thesis, albeit for different reasons. First, there are the parents who send their offspring to universities to be educated by the best teachers and researchers in the respective disciplines, only to find that the best talents in these disciplines are committed to project and contract research and, therefore, are not available for teaching. These parents are convinced that reduction or elimination of these research contracts would keep professors on the campus and in the classroom and would vastly improve the education offered the students. Second, there are the students themselves, who not only prefer to be taught by professors rather than graduate teaching assistants, but who also view much of the contract research as being in support of policies and activities of the Department of State or the Department of Defense, policies and activities which they find often unacceptable. Third, funding agencies are becoming increasingly critical of the way universities accomplish certain types of research. They contend that universities seem to find it difficult to accomplish problem-oriented research as timely as do independent research agencies. Also, research according to the project sponsor's specifications and multidisciplinary research appears to be more easily accomplished by independent research agencies. A NASA Task Force, for instance, reports [11] that in its Sustaining University Program, interaction between the social and physical sciences was found to be very limited. The small amount of social science involvement that did exist was usually a subproject that did not interact with the other research [5]. Similar comments can be heard from research administrators in agencies such as the Environmental Protection Agency, the National Science Foundation, and even the United States Department of Agriculture.

If one supports a view which states that universities (and public research agencies) must have contact with problems of people and problems of groups of people and organizations; that, as producers of knowledge, universities must be in contact with the problems of society; and that, as distributors of knowledge, they must

Table 1. Professional man-years devoted to various problem areas by the USDA, State Agricultural Experiment Station, and the Cooperative Extension Service in Fiscal Year 1971

Problem Area	Coop. Ext. Serv., 1971, U. S. ^a	Coop. Ext. Serv., 1971, U. S., Excl. 4-H Youth	USDA, SAES 1971, U. S. ^{b,c}
	—percent effort—		
4-H Youth	32	—	—
Improving Farm Income	31	46	58
Family Living	13	19	1
Food and Nutrition	8	12	6
Community Develop- ment	7	10	6
Marketing	4	6	7
All Other ^d	5	7	22

^a Derived from tabulations available in the office of the Director of Cooperative Extension, Indiana.

^b Derived from the Table II-D series, Inventory of Agricultural Research, Science and Education Staff, and tabulations available from the Office of the Regional Director, NCR, 1972.

^c Includes USDA contracts, grants, and Cooperative Agreements from USDA with SAES.

^d Recr., Wildlife, Natural Beauty, Impr. of Environmt., Soil and Water Cons., Forestry, Safety, Interntl. Programs.

teach in relation to problems [6, p. 14], then the above trends and pressures have significant implications for both universities and continuing education. Most socially significant research of today is large-scale and in need of funds which universities themselves cannot supply in adequate amounts. Thus, if a significant amount of this type of research should move outside the universities, their teaching effectiveness (including that of continuing education to the extent that it is connected with universities) would decrease.

There are a number of reasons to believe that a wholesale shift of the type indicated above will not take place, or at least need not take place, provided universities (and public research institutes) do not remain fatuously complacent. I shall come back to this point in order to undergird one of my premises, namely, that the current sources of research support (universities and public research institutes) for continuing education will remain major sources, but other sources will gain in relative importance. These other sources will become relatively more important if current sources are slow or unimaginative in adapting to the changing environment.

Research Needs for Continuing Education

Research needs for continuing education may be classified into two basic categories. The first of these concerns itself primarily with subject matter content in support of continuing education. The other deals with questions of evaluating and improving continuing education. I shall discuss each of these in turn.

Research to supply subject matter content

In recent years this profession and the Association have given extensive (and, perhaps, excessive) attention to problem areas which should be addressed by the profession in the decade ahead. More than merely a few authors and committees have studied this question [cf. 1, 2, 3, 4, 7, 13, 17] and provided recommendations which have a surprisingly high degree of agreement from one author to the next and from one committee to the next. While most of these reports are explicitly addressed toward research, they all imply that research results need to be extended in order to be useful; that the results will, indeed, find their way into the continuing education process; and that the problems addressed by research are, to a considerable degree, also those where continuing education needs to be carried out. In view of this we shall refrain from devel-

oping "still another" long catalogue of subject matter areas. Instead, I shall attempt to capture the essence of some of the papers and reports mentioned above.²

The total subject matter to be researched may conveniently be divided into five areas: Commercial agriculture, resource economics, community development, international economics, and methodology and techniques.³

Commercial agriculture.—This is currently one of the less popular areas within the profession; yet, it abounds with relevant issues. The question of "Who will control agriculture?" is currently very poorly answered, although our clients, both rural and urban, are asking to be advised and educated in these issues. Related issues deal with the generation, saving, and investment of farm-produced capital. Research in these areas will not only fill a continuing education void, it can also be highly imaginative in terms of considering the trade-offs between private and social costs and returns, concepts to which our society is becoming increasingly sensitive.

Management of firms (farm and farm-related) is, to some extent, considered in the above issues. It should be considered separately for several reasons. First, a better understanding of the dynamic managerial process will aid in the understanding of the issues mentioned earlier. Second, and more important, it will be necessary for continuing education to serve a group of clientele which has not been well served in the past decade or two: the intermediate and small farmer, the small independent elevator operator, the small independent food processor, etc.⁴ Finally, the large commercial farmer will continue to ask for educational programs.

The behavior of the consumer and population change and the resulting demand for food and fiber also need to be researched. These research results are of importance in the continuing edu-

² In preparing such a summary, I will probably do all of these authors injustice, but, hopefully, not to a high enough degree to become intolerable.

³ Most readers will recognize that the first three areas coincide with the research committee structure in some regions.

⁴ The simple classification of "intermediate and small businessman" understates the complexity of the problem, since this class consists of several subclasses of clientele, including at least the following: (a) the business which stopped growing at a marginal income level because of either lack of motivation, lack of ability, or lack of resources of the owner; (b) the beginning small businessman who has good entrepreneurial ability but limited resources; (c) the beginning small businessman who has neither ability nor resources.

cation of the general public on such issues as the relationship between food prices, consumption, income, legislation regarding use of chemicals, food quality, grading, etc. Therefore, much imaginative research is needed to develop new theories of consumer behavior and market performance. Received economic models are largely silent on such key problems as product and brand proliferation, deceptive advertising, labeling and packaging, and buyer-seller communications [1].

Resource economics.—Some of the issues here need considerable theoretical effort (divergence of social and private cost and returns), and many of the issues will be regional in scope. Some questions which are currently asked by both our rural as well as urban clientele are the following: What is the effect of cultural practices, including irrigation, on soil conservation and the water supply? What are the relationships between use of agricultural chemicals and soil and water pollution on the one hand and farm income, food supply, and supply stability on the other? What are the magnitudes of changes in the current relationship of social and private costs and returns as caused by potential legislative action related to environmental protection? What is the likely effect of such legislation on intra- and inter-industry structure? What are the characteristics of the rural/urban interface in such areas as supply of waste and demand for recreation?

Community development.—While the term "community" rather than "rural" development is used here, I am viewing the clientele to be primarily those in the rural areas, with allowance for questions for the rural/urban interface. The reason is a highly pragmatic one: Our profession's expertise lies with rural problems. Further, it is the primarily rural community that has not been given the kind of attention by the economist, sociologist, civil engineer, etc., which has been bestowed on cities in recent years.

If I interpret correctly what is being written and said in this area, then this is the subject matter area in our profession with the least research support (see, for instance, Table 1). At least two reasons may account for this. First, this is the youngest subject matter area to which our profession has turned its attention. Second, it may well be the subject matter area which is least amenable to understanding and treatment by only a single discipline.

Again, certain conceptual (and methodological) issues, such as multiple goals, quality of life indicators, large-scale systems analysis (not systems optimization), regional economics, and the

theory of public goods and services, need adaptation to specific problems of community development. Once this is accomplished, meaningful empirical research can and will follow and the results made available to the community decision makers.

International economics.—Some of the issues under this heading could have been placed under "commercial agriculture," others under "community development." However, the issues of international trade, the effects of technological change and population growth around the world on the agricultural and general U. S. economy, the interrelationships of economic development abroad and at home are topics which need continued education and research efforts in their own right.

Methodology, theory, and techniques.—I started this section with one of the less popular subject matter areas (commercial agriculture), and I am ending it with one that is even less popular with the spokesmen for our profession. Indeed, the trend from basic research and from research on theories and methods towards mission-oriented research is general. Funding agencies are asking more and more "Does this proposed research project propose to fulfill a practical need?"

It is not my intent to argue that this is an unhealthy trend. Nevertheless, it needs to be pointed out that some of our most important advances in all branches of science, including the social sciences, have come from research that was originally quite far removed from application of that research. Specifically, let me point out that when "optimization" was the "in thing" with the profession, some methodologists started research work on simulation models. At that time these efforts were largely considered theoretically unfounded (by one camp) and as merely another misdirected effort on the part of narrow-minded methodologists to get another paper into the *Journal* (by the other camp). Witness, however, that today this technique has permitted the analysis of some of the more significant problems that agricultural economists have ever approached and in a manner which has made it possible for the decision makers to accept the results. Furthermore, many of the research needs cited immediately above depend on theoretical or technical advances for an effective fulfillment. Thus, in the interest of continuing education it appears unwise not to continue emphasis on a reasonable and viable amount of research in methodology, theory, and techniques. This need not conflict with mission orientation. Any conflict that arises

is likely to be between the researcher who refuses to solve real problems and the adult educator who refuses to subject real problems to rigorous analysis.

Evaluating and improving continuing education

Continuing education can be viewed as a subject matter area and as such is subject to being researched. The research topics discussed below view continuing education in that vein.

Assessment of benefits of continuing education.—Economists think it quite natural to perform cost-benefit analyses on watershed projects, irrigation projects, improved agricultural data systems, etc., but similar rigorous and persistent analysis of continuing education does not receive much attention.⁵ To be sure, some sort of evaluation based on the "public point of view" and the visceral feelings of individuals and committees about their belief that they can diagnose and predict social change and therefore can decide what continuing education programs to shape goes on continuously. But, whose public views and whose visceral feelings should be recognized? Do we have any empirical evidence and conceptual framework that will aid in answering this question? A number of studies are available which evaluate investment in human capital in general and continuing education in particular [9, 16, 18]. Particularly for the agricultural and rural sectors these studies are much too aggregate to be of value in decisions which have to do with the reallocation of educational resources between subject matter area or groups of clientele. For instance, should the Cooperative Extension Service continue to spend 32 percent of its professional resources on 4-H youth work, 31 percent on improving farm income, and 37 percent on all the other subject matter areas discussed in this paper and elsewhere? With this particular mix in public investment in education, what are the total social benefits (and its costs) and who are the recipients of the private benefits? Are the recipients bearing an appropriate share of the costs? Are private benefits from continuing education in some sectors so high that this particular sector could—or should—be persuaded to shoulder costs of continuing education rather than rely on public funds? Given a certain mix of publicly funded continuing education, which groups are being bypassed and is the number and size of

these groups increasing or decreasing? I am in no way arguing for an "optimum" mix, primarily because I do not think that it can be found, given the current state of the arts. I am not arguing that costs and benefits should be the only criteria for allocating public funds to and within continuing education. I do, however, suggest that there is room and need for important research with policy implications.

Clientele's information needs.—Closely related to the above is the question of what our clientele, once identified and the mix determined, should be taught. I continue to be impressed by research findings [e.g., 10, 15] which show that farmers rely on the Experiment Station/Extension complex only for a relatively limited amount of information. Other sources of information, such as farm suppliers, TV, radio, trade press, neighbors, etc., tend to be more important and more frequently interrogated.⁶ Similarly, program development (for continuing education) often finds the planners guessing as to what the clients need. Little or no effort is made to research the question on a continuing basis, either in form of formal surveys, or by analyzing the data needs of a conceptual model which represents our clients' environment.

Change in institutional structure.—Our clientele is changing (see Stanton [14]). To our clients of long standing, the producer of food and fiber, the processor, and the distributor, we are now adding the consumer, legislators, government officials, members of regulatory agencies, and others. Since many of the agricultural and rural problems (community services, environment, pollution, ownership structure, and control of natural resources, etc.) will be decided in the political arena, we face a considerable task of educating the nonagricultural rural resident as well as his urban friends. Is the current structure of continuing education suitable for teaching these audiences? What are the dangers of reorganizing so that we miss both our new and our old clientele?

Relevance of research results.—Relevance is an "in word" which is rapidly losing its relevance. However, relevance of research results in the true sense is of particular importance to continuing education. For research results to be relevant for continuing education they must fulfill three conditions. They must address themselves to sub-

⁵ A similar argument could, of course, be made with respect to research.

⁶ Some of the information disseminated by these sources may well originate with the Experiment Station/Extension complex.

stantial problems, they must address the total problem (and not merely the discipline's subset), and they must be timely. These fundamental conditions, in turn, call for certain characteristics of research in support of continuing education. First, research will generally have to be multidisciplinary in nature. Second, research needs to be completed within a reasonable period of time.

We have argued above (see **Changing Research Environment**) that the university establishment has not been exemplary in its performance with regard to these characteristics. We have further argued that this is leading funding agencies to examine whether universities are in the best position to execute this "relevant research." We are now adding the additional argument that this type of research is necessary in support of continuing education. Thus, I am presenting a challenge to research administrators to develop a research environment which makes this type of research possible. Johnson [6, 7] points out that it is possible, although by no means easy, to accomplish multidisciplinary research, and he has considerable evidence to back up his statement. Johnson favors a flexible team approach, with the team being dismissed upon completion of the research project. He is skeptical about research institutes. However, Hansing [5] provides at least two examples of successful institutes. We conclude that the nature of the problem and the particular circumstances should be analyzed before options are taken in favor of one over the other.

Timeliness of research, regardless of whether or not it is multidisciplinary, is of the essence for research in support of continuing education. Yet, in universities the typical research project takes about five years from its conception to publication of results. It can be said without qualification that such a timeframe is inadequate if research is to be in support of continuing education. Can and should universities organize so as to improve this timeframe? If they do not, to what extent will they be able to remain a viable source of support for continuing education subject matter, relative to other public and private research organizations?

Pervasiveness of research.—Deduction as well as empirical evidence [9] suggests that a certain amount of research is pervasive over a wide geographic region. For example, changes in the structure of international trade relationships, if they affect one of the Cornbelt states, are likely to affect other Cornbelt states in very much the same manner. Thus, research to analyze these

effects needs to be carried out in only one of the states, while the results are useful for continuing education in all of the states. In recognition of this pervasiveness of research, regional (research and extension) committees have been established. These are designed, among other things, to prevent research duplication within the land-grant complex and to facilitate regionwide dissemination of results. It would be grossly unfair to charge that these committees have been without effect. It would be an equally gross mistake to presume that an optimum organization has been established. If for no other reason, the structure deserves scrutiny because it represents a source of research support to continuing education which is growing relatively less important.

Descriptive information.—The educator is frequently in need of descriptive information on a problem. This descriptive information must be disciplinarily sound, but for relevant problems it is rarely confined to or derived from a single discipline. This makes assembling of descriptive information a difficult and multidisciplinary task if it is to meet the scrutiny of our clientele. Also, often this descriptive information (and underlying concepts) is not readily available and can be obtained only through further experiments and research.

The researcher is generally not inclined to provide this descriptive information unless it is part and parcel of a decision problem he is attempting to solve. Thus, a deliberate effort will have to be made to meet this research need for continuing education.

Delivery systems.—Much need for research exists in this area. These needs are discussed in a separate paper [8].

Concluding Comment

The above discussion of research support for continuing education addressed itself to the delivery of research which secures the subject matter foundation and improves the target, the efficiency, and the delivery for continuing education in agricultural economics. I wish to close by pointing out that the adult educator in agricultural economics may need additional research support, support of the type which cannot be provided by his research colleague in agricultural economics. Knowledge generated by that type of research deals with learning dynamics of individuals and groups, the relationship between age, cultural factors, nutrition, etc., and the ability and motivation to learn and adapt, among others.

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Discussion: T. T. WILLIAMS, Southern University

Professor Stanton's opening remarks establish the tone of my discussion of three well-developed papers. He stated, "This paper is not . . . academic. Neither is the topic. It is . . . popular these days to challenge the establishment, and such challenges should be welcomed even if some of the questions are aimed in our direction."

My reaction to the three papers within the context of continuing education and research was cued by Eisgruber's comments that, ". . . it should be understood that a good researcher in any discipline will often anticipate important problems before they are recognized by the public." Finally, Kolmer states that, ". . . we are being challenged from many sources because we have assisted one segment of rural America but have virtually ignored another segment."

In the process of challenging the establishment in a nonacademic manner, I want to review some important problems the researcher should anticipate or provide some relevant answers to if continuing education is to be meaningful to the poor, alienated, and disadvantaged clientele.

A recent study by the economic unit of U. S.

News and World Report [1] revealed the following findings:

- In 1959 more than 22 percent of the total population (39.5 million) had incomes below the poverty level.
- In 1968 less than 13 percent of the population (25.4 million) had incomes below the poverty level.
- In 1971 about 12.5 percent of the population (25.5 million) had incomes below the poverty level.

A brief analysis of these figures will show that since 1968 in the most affluent society in the world our poverty group has stabilized at about 13 percent. Have we accepted the notion that we must live with 13 percent of our population poor?

My remarks are limited to this group which I call the "residuals of an affluent society," or those persons outside the mainstream. I am using the scholarly papers of these three gentlemen to challenge the establishment to do something about reducing this stabilized percentage.

So that I might put into perspective my dis-

cussion of these three papers, let me say that my remarks are couched in the armor of the land grant colleges in general and the 1890 Land Grant Colleges in particular.

The 1890 Land Grant Colleges are the 16 institutions created by Congress after the Civil War in states having a large black population. Through the years these colleges have been an important force in the development of people who are disadvantaged, alienated, and deprived. I need not remind you that these institutions have also been training centers of black leadership in this country or that these colleges have developed a kind of expertise so necessary in making the American dream a reality for all people.

In recent years (with hard money) accelerated progress has been made by these colleges in the areas of continuing education, research, and extension.

It is at this point that I want to add another dimension to the three papers. *The fullest utilization of the experienced resources located at these institutions for continuing education and research should be a major thrust.*

Any society that leaves development and implementation of programs to one group or institution is inviting trouble. Historically, this has been the case and we must take action *now* to rectify this situation by involving all groups and institutions in the development and implementation of programs.

Continuing Education

The delivery system for social and economic goods long established and still developing can and must aid the "residuals of an affluent society." This is particularly true for those who are inside the establishment and those who are searching in a confused manner to understand and negotiate the system. To me, this is where continuing education or extension, if you will, must assume a major role. Certainly the specifics will be based upon research findings, but let me remind you that located on each 1890 Land Grant College campus is a store of research findings that will stagger the imagination. We must find a way of retrieving and utilizing such research findings for the development of the continuing education thrust.

We do not have to wait for more study findings, we merely have to accept the fact that these colleges, so long neglected in conventional research, have developed an expertise which this society can no longer do without. For example,

we know that it is difficult to develop self-reliant communities or poor people without developing in the people the ability to perform leadership roles needed to achieve group goals. Yet the out-migration of people from rural areas to urban centers has altered leadership structure and leadership competence in rural America.

Rural leaders with ability and initiative have moved on, and those leaders who have emerged to fill the vacuum experience difficulty in moving the poor people and the community forward.

It is within this overview that we need to re-evaluate our country's continuing educational priorities for this clientele—the poor. I am not arguing that we should not devise a "laundry list" of the land grant clientele as Professor Stanton so eloquently stated. However, I am in agreement with Dr. Eisgruber when he said that unless we devise a means of helping the poor, society will find other ways of accomplishing this outside the land grant college complex.

Failure of the residuals of our affluent society, "the poor," to utilize fully the many services available to them (federal, state, and private agencies) attests to the need for reevaluating the traditional approach to continuing education or extension as the speakers have suggested.

Our traditional rationale for extension was to provide free technical assistance to the alienated and to the disadvantaged rural people. With the passing of time, the percentage of rural people engaged in farming declined and those who remained controlled large acreage.

Yes, we have witnessed in recent years the broadening of the extension clientele to include both the rural and urban population. But modern extension personnel have found it rather difficult to deliver the needed services to their adopted clientele—the "residuals of affluence."

I am not going to debate the pros or cons of the *Hard Tomato—Hard Times*, but it is no secret that many extension personnel have favored the large farm operator and the successful urban group with their services.

Agricultural economists and the land grant colleges have the responsibility and opportunity to meet the continuing education needs of the people left behind. We must provide leadership in the areas of rural development, land use, planning, and the allocation of our limited natural resources.

When we have done these things, I think, we will have altered somewhat the food industry orientation of Professor Stanton's paper to one of "people" orientation.

Research

Research is another area in which we must reassess priorities, particularly as research findings support our continuing education thrust.

By now you should know my position. For those who miss the point let me restate: "*There is a reservoir of research data and study findings so necessary for the implementation of a continuing education program for that group called the 'residuals of our affluent society.'*" I am speaking of "applied research" with "*now application.*"

I agree with Professor Eisgruber when he states that the total mission of research is considerably broader than the support of continuing education, and I support his statement that universities must have contact with problems of people and problems of groups of people and organizations.

As producers of knowledge, universities must be in contact with the problems of society. As distributors of knowledge, universities must teach in relation to problems. In order to carry out these missions universities should know the needs of their clientele.

It is an accepted fact that agencies assigned the responsibility of assisting the "residuals of affluence" are not satisfied with the progress of their amelioration programs nor are they pleased with the acceptance of alternative opportunities for upward mobility of this group. This belief is held so strongly by some of these groups that they have accepted a Biblical interpretation, namely, "the poor will always be with us." I join with the authors of the three papers in refuting this idea. We strongly feel that effective economic development programs for the "residuals of affluence" must be based upon reliable data concerning the clientele to be served. Just as important, I will go a step farther than either of the authors and argue that the research should be

undertaken by a staff with whom the "residuals of affluence" have rapport.

While this country has the knowledge to explore the height and depth of this universe for life, we like the commitment to help people rather than things. If we are to reduce the percentage of our population who are the "residuals of an affluent society," we must commit ourselves to an effective continuing education program for this clientele. The urgency of the 1890 Land Grant Colleges assuming the continuing education and research responsibilities for this clientele is apparent.

Over the years the 1890 Land Grant Colleges have accumulated a reservoir of expertise on the "residuals of the richest country in the world." Individuals at these institutions have the sensitivity and track record of accomplishment. These colleges have traditionally drawn many of their students from the poor, alienated, and disadvantaged, and the characteristics of their student body mirror the homes in which the poor, alienated, and disadvantaged people in this country reside.

Turn to the annals of any periodical depicting outstanding individuals in agriculture, business, politics, engineering, or you-name-it, and graduates of the 1890 Land Grant Colleges will be well represented.

The 1890 Land Grant Colleges have developed a kind of expertise to make the American dream a reality for all people.

Join with me in congratulating the three authors in presenting us with a provocative and challenging treatise on continuing education, delivery systems, and research. Implementation of their recommendations will move us closer to fuller utilization of our limited resources for solving this nation's number one social problem.

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Discussion: KEN D. DUFT, Washington State University

Stanton suggests that his paper is not very academic. Yet in his introductory remarks, Lee Kolmer states that his paper is very academic—and so is Stanton's. In my view, a more detailed reading of the papers will lend support to Kolmer's contention. In fact, all three papers are highly academic, and this stimulates my initial concern. A department chairman, an extension director, and an assistant department head have

all chosen to contemplate the future of continuing education from a highly academic viewpoint. Jim Hightower of *Hard Tomatoes* fame would likely argue that the time for academic discussions has long passed. As a practicing extension economist, I must agree. The highly academic approach becomes a luxury our profession can ill afford to acquire at this late stage.

My colleagues Stanton, Kolmer, and Eisgruber

have presented academic yet interesting papers on the clientele, delivery systems, and research support as they relate to continuing education in the 1970's. For the sake of brevity and simplicity, I shall direct my remarks to a review of each author's major contributions and contentions in the order in which they were presented. An explicit attempt shall be made to call attention to those remarks which, in my opinion, warrant re-statement, clarification, or further professional scrutiny. In the concluding portions of my remarks, I will ask you to consider a number of paradoxes—most of which seem to have escaped the above authors' thoughts, but each of which requires a settlement before continuing education in the 1970's can become that which we all wish it to be.

Our Clientele

If, as Quentin West suggests, "there are termites in the foundation of our ivory tower," then why should we act so aghast when the exterminator calls them to our attention? Stanton's reaction to the *Hard Tomatoes* release is a heartening one. I am pleased with his positive response and his expressed belief that "public accountability is as American as apple pie." Unfortunately, this particular "apple pie" has contributed (unnecessarily) to a number of upset stomachs throughout our profession. The report titled, "A People and A Spirit," and a number of its predecessors did, as Stanton suggests, represent an internally generated expression of our profession's desire to meet the challenges of the 1970's. Hence, our deficiencies lie not in our ability to identify needs but in our willingness to do something about them. Hightower's exposé provides us with an all too florid view of this failure.

Stanton suggests that the ultimate American consumer of food and fiber has been the prime recipient of the output of our land grant system. His statement may be accurate. Yet, I tremble at the thought of determining if the end-product distribution was a socially equitable one. And, moreover, at what point were we given the responsibility for selecting our own clientele and establishing our own program priorities? Hightower's argument that "outside constituencies" should become a part of the decision-making resource allocation process now begins to take on some substance.

By "historic mandate," Stanton recalls, actual program emphasis has been on the producers of food and fiber. "With considerable hesitation," he continues, "there is (now) some orientation of

programs to retailers. . . ." If our programs are extended directly to the American consumer, Stanton theorizes, our farm policy must divide into two parts: (1) the use of natural and human resources in rural America and (2) food policy. Unfortunately, Stanton's amorphous consumers are a thankless lot who are unlikely to expand our budgets in gratitude for services received. Stanton rests the remainder of his paper on the hope that a common ground may be found between the interests of producers and consumers. With continued concentration within and between the producing, marketing, and retailing sectors of our economy, this common ground of mutual interest may become more easily identifiable. Yet, the major questions remain unanswered—where and how does continuing education enter the scene? I agree with Stanton that we might begin by bringing the various interest groups together for the purpose of adult education. What Stanton fails to mention, however, is that before this feat can be accomplished we, ourselves, must divest ourselves of special industry alliances, client associations, and commodity orientations. This, in itself, becomes a necessary first step, one which we must both accept and accomplish before multiple (and sometimes conflicting) special groups will look to us for common leadership in the area of adult education.

Delivery Systems

Kolmer's contribution consists of a listing of delivery system prerequisites, each of which must exist before "we are to have an effective delivery system for continuing education in the 1970's." Kolmer's delivery system must be accessible, have the capacity to deliver an unbiased message, and be responsive and accountable. I would argue that of these conditions the second becomes most difficult for the practicing extension worker to attain. Too often our clients interpret our unbiasedness as indecision, incompetence, or lack of concern. The choice between growth and environmental quality mentioned later by Kolmer is an example of an area where neutrality is most difficult to retain.

Kolmer argues that our existing extension framework is an indispensable one. Yet, I do not agree that each link in the country-area-state specialist chain is vital to successful delivery. Moreover, as we become concerned more with non-traditional problems, it may become prudent to bypass intentionally one or more of these links in order to assure the delivery of a message.

I applaud Kolmer's charge that a rigorously

developed journal article may be a poor vehicle for conveying our message to county commissioners, state agencies, and commodity groups. Our profession must recognize that the message will be delivered only if "it is presented in a manner that is comprehensible and fitted to the environment surrounding the intended recipient."

Research Support

Continuing education and research go hand in hand, or at least this would be the sentiment of all three authors. Eisgruber reminds us that research and extension have two-way complementarity in the areas of problem identification and solution. Further, Eisgruber maintains that research has a broader mission than the support of continuing education. Acceptance of this assertion would, in my opinion, depend on one's own interpretation of the relevant terms. If continuing education is but a synonym for the cooperative extension system, I would agree. Yet, to many, continuing education refers to all off-campus educational programs, most of which stress the practical application of new knowledge. In this sense, all research, even basic research and that conducted under contract, is likely to have practical implications.

Eisgruber's review of the thoughts of Robert Nisbet proved to be extremely thought-provoking. Can we ignore those parents, students, and funding agencies with their expressed concern over our commitments to project and contract research? Have we really abandoned our teaching obligations or delegated them to our teaching assistants? And what about our ability to accomplish, on time and within specifications, problem-oriented research?

If we have failed in the above areas, Eisgruber suggests it may be due to our reluctance to confront "problems of people." At this point I would like to extend the discussion by arguing that if we have failed to develop a social conscience, it is at least partially due to the reluctance of those of us in extension to approach a social problem. We seem to find livestock, crops, business, and markets more attractive than people. We vigorously launch into an economic dissection of an agribusiness firm, its inventories, its assets, and its finances but conveniently ignore those social ills within and around the firm.

Eisgruber maintains that the research needs of the 1970's will fall into two categories: (1) to provide subject matter content for continuing education, and (2) to improve the process of

continuing education. In my opinion, Eisgruber has overlooked a third and perhaps more important category. Should not some research be designed to identify potential social problems where continuing education might fulfill a need? Earlier in his paper he states that, "a good researcher . . . will often anticipate important problems before they are recognized by the public." If this is true, then let's use this attribute to direct some of extension's efforts to those areas where our abilities can be used to deal with social issues. This guidance, plus supporting subject matter and improved procedures, will undoubtedly contribute towards more potent programs in the 1970's.

Paradoxes in Continuing Education

As a final note, I have chosen to list five paradoxes with which continuing education must contend in the 1970's. In his discussion of clientele, Stanton alludes to some portions of the paradoxes. Yet, to a large degree, they remain unanswered.

First is the paradox that each of us in the field of continuing education is now being asked to contact new audiences, to introduce new complex people involvement processes, and to modify our teaching materials. Yet, it is expected that we will take on this new effort, strangely foreign to many of us, in the face of diminished staff resources and increasing demands from our present clientele and society in general.

Second is the paradox that, while we want to be sure that no one who can benefit from receiving our educational experience is prevented from doing so because of income, status, or color, we also know that there are many people in these categories and in others, too, not now involved in our programs because they have chosen not to be.

Third is the paradox that we may experience increasing hostility and perhaps cutbacks in funds from our traditional audiences if we fail to find Stanton's common ground or redirect our efforts to low-income or minority people.

Fourth is the paradox that some low-income and minority groups are hostile both to the introduction of new technology (e.g., mechanization) and the discovery function that creates this new technology and ideas. Yet, new discoveries and new ideas have always been the products of good research and extension.

Fifth is the paradox that while we say we want everyone who can benefit to participate in our

educational programs, we would deny those who say they discriminate access to our program offerings.

The above are purposely void of value judgments. They represent factual operational barriers to meaningful programs in the 1970's. All three papers would have proven more substantial, in my opinion, had the authors substituted some of these practical concerns for their academic concerns.

Sectional Meeting E CONTINUING EDUCATION IN THE 1970'S

Subsection E.1—Contributed Papers

Chairman: RAY SCOTT, FES, USDA

Papers: David L. Armstrong and Norman A. Brown, Michigan State University, "Continuing Education—Not Business As Usual"

Glen C. Himes, David Hahn, and James Stitzlein, Ohio State University, "The Use and Evaluation of

Computer Assisted Instruction for Teaching Introductory Principles of Production Economics"

Frank Osterhoudt, New Mexico State University, "Employment and Training Prospects for Environmental and Resource Economists"

Donald Osborn, University of Missouri, "Some Aspects of the Fiscal Response to External Funding Among Rural School Districts"

Subsection E.2—Contributed Papers

Chairman: GEORGE CAPEL, North Carolina State University

Papers: Stephen Harsh, Michigan State University, "The Michigan Computerized Forward Planning System"

Harold Guither, University of Illinois, "Bargaining in Agriculture—Potentials and Pitfalls for Continuing Education Programs Among Livestock and Grain Producers"

Kenneth Schneeberger and Jerry West, University of Missouri, "Research and Education Needs of Those Living on Small Farms: Production and Consumption Aspects"

Kenneth Casavant, Washington State University, "Two Teaching Experiments: Evaluation and Interest"

THE 1972 FELLOWS ADDRESS

Allocations of Colleges and Economists

EARL O. HEADY

WITH few exceptions, the profession of agricultural economics in the United States is practiced in the two major citadels of agricultural intelligence, namely, colleges of agriculture and the U. S. Department of Agriculture. Research and educational programs in these two major public institutions, as well as the structure of income transfers flowing from the USDA, have come under growing criticism in recent years. Foundation of the criticisms has been that of equity and the concentration of public payments and benefits of research and education to the wealthy, while the poor and disadvantaged of rural areas are neglected.

The most recent, and perhaps the most devastating, attack on programs of the agricultural colleges include the recent Congressional activity through the Migratory Labor Subcommittee hearings on Land Grant Colleges and the hurried paperback, *Hard Tomatoes, Hard Times* by Hightower [11]. Appearance of these two communications caused a scurry among land grant university administrators, who generally have reacted to these criticisms through "white papers" defending ongoing patterns or "promising to do more."

Agricultural economists have been engaged in a bit of identity crisis and soul-searching in recent years [2, 3, 12]. As a profession, they have engaged more in this evaluation of themselves and their activities than have the other disciplines that are financed and administered through colleges of agriculture. It is possible, however, that their soul-searching has been more of concern about whether they should serve as econometricians, general economists, or applied scientists. Frequently, the person serving in one of these roles knows full well the group with which he is trying to identify, wanting only to be left alone by others of the profession who—by their own criteria, values, and interests—are trying to tell him how he should orient his activities. This dialogue among agricultural economists, somewhat of both relevance and interest, is not precisely the same set of issues posed to the agri-

cultural colleges by those who accuse them of following conventional and obsolete lines of research, selecting or submitting to an elite clientele, causing income problems to fall on farmers and rural communities, and ignoring the poor and underprivileged. However, the agricultural economist's quest for identity and relevance is not unrelated to the issues being placed before the land grant institutions. It is likely that as long as there are agricultural economics departments to administer and finance, these processes will be conducted by colleges of agriculture; or equivalently, there will be departments of agricultural economics only as long as there are colleges of agriculture. Hence, members of the profession have both a professional interest and a financial stake in the extent to which agricultural colleges focus their resources on problems of urgency to the publics they serve and on problems which are relevant in terms of continuous financial support.

Analysis of the Hightower Report

Returning to recent issues put before the land grant institutions, I focus mostly on Hightower's hurried monograph. Its voids are numerous and his biases are obvious. While the work is posed as the product of research, it is more in the manner of a journalistic exposé, even to the manner of the presentation. The conventions of research at least would lead a writer to recognize other research publications [1, 2, 5, 6, 7, 8, 14] that have covered the same general findings. Hightower either does not or cannot recognize that certain of his major propositions have been presented previously, especially by agricultural economists, and with an analytical framework to support them. In these respects, he mentions none of several penetrating analyses of poverty and low-income problems that are widely known in this profession. He implicitly accuses land grant personnel of placing zero, or very small, weights on variables contributing to welfare of low-income farmers, rural communities, and utility of consumers. Yet, he commits exactly the same "error." He places very small weights on dimensions of agricultural research which generally improve resource efficiency and bring

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broad social gains in development. His main omission lies in evaluation of consumer gains and losses. His thrust here is that agricultural research has been warped towards gains by large-scale farmers and the agribusiness sector and sacrifices by the consumer—for example, hard tomatoes imposed on consumers for the sole purpose of harvesting the product by mechanical means for the convenience and profit of the growers and processors. In this general realm of outcomes, Hightower has the major results inverted and nearly judges black as white. Given the extremely low price elasticities of demand for food and the historically low outward mobility of labor and other farm resources, the major gains from agricultural research per se have been to consumers. The numerical basis for this outcome is apparent and elementary to agricultural economists, although perhaps unknown to Hightower. With low demand elasticities, the continuous short run characterizing agriculture causes revenue to be less than under a smaller output and allows the consumer to buy more food with the same outlay (or to require a smaller outlay for the same amount and collection of food). So much is this true that our administrative institutions should have long ago changed their names from “agricultural colleges” to “colleges for consumers.” Further, Hightower completely underestimates the ability of the consumer to exercise options open to him in terms of prices and incorporated services of quality and personal convenience. The tomato is a widely adapted plant. There are few places in the U. S. where it is not grown in gardens and on farms. Roadside stands and other supply sources prevail where one can, if he wishes, buy soft, red, hand-picked tomatoes. Yet, the roadside stand or on-farm sale of tomatoes is not a large and flourishing business. Why is this true, if consumers prefer soft-red rather than the supposedly hard-amber tomatoes? Although they are public institutions, land grant universities do not have legal powers to force consumers to subscribe to a weekly quota of hard-amber tomatoes. Agribusiness does not station guards at the edge of town blocking consumers from these country supplies. Evidently, under the budget constraints affecting their choices, consumers decide under prevailing prices and convenience that their utility is greater if they substitute the supposed hard-amber product from the supermarket for the soft-red fruit from the country. The tomato just does not provide a very good basis for arguing that land grant universities warp the consumer’s

choices and depress his welfare. The forces of supply, demand, and competition are not that small, particularly when entry into tomato production requires only a 15-cent package of seeds, a hoe, and a small plot of land.

Other Hightower examples selected to show collusion of land grant institutions and agribusiness in depressing consumer utility lack content. Yet, much of what he claims is true. The major research and educational programs of the land grant universities have focused mainly on affluent farmers and establishments around agriculture and relatively little on the poor and disadvantaged families, farms, and business establishments of rural communities. Large farms and businesses gain most from the ongoing flow of research and have the most to say about programs. In fulfilling the pressure of these interests, major programs of the agricultural colleges work to the disadvantage of other people on farms and in rural communities. Every major biological innovation applied on farms is a substitute of capital technology for both land and labor. Mechanical innovations especially replace labor but also serve as a land substitute. The effect of labor replacement abetted by college programs is to leave low-income and underemployed labor stranded both on farms and in rural towns. The effect of land substitution is expanded supply capacity of agriculture which, because of low resource mobility and price elasticities, leaves a pall of income depression generally hanging over agriculture—especially by the smaller farmers who gain little absolutely from public compensation payments. The depopulation effect of these substitutions is underemployment and a state of economic and social decay throughout the towns of rural areas.

Impact of Technology on Communities

Numerous groups and many individuals experience gains through the production, distribution, and use of capital items which represent new technologies coming forth from the research, education, and development programs of public research institutions and private firms. But equally, sacrifices or losses are brought to those of rural areas whose business volume, employment opportunities, and capital values are eroded through the substitution of capital technologies for labor and through the larger and fewer highly capitalized farms so encouraged. Certainly land grant universities do not program nearly as many resources to helping solve these problems as they do for the biological and physical innovations

which indirectly cause them. While there are some important exceptions revolving around individuals, these institutions have not equally concerned themselves with solving the problems of the rich and the poor and the big and the small.

It is common knowledge throughout the agricultural economics profession that rapid technical advance, induced by research and education in the college, has replaced much of the foundation for businesses and employment in rural communities throughout the Corn Belt, Great Plains, and elsewhere. Technical advances have been particularly effective in depopulating rural areas of the Southeast, with some counties losing more than half their population in the postwar period. The costs falling on these people have been heavy, as they have been for their rural social institutions. Large numbers of these people migrated to northern cities where their lack of education relegated them to slums and ghettos. The older people remaining in rural areas are no better off; they live in squalor and work infrequently. While agricultural experiment stations have concerned themselves with more food and fiber, their lack of work on the inadequate diets of unskilled migrants and poor families has been notable. Evidently, research and education on these problems result more from the pressure of concerned urban leaders and legislators who push through programs with spillover effects for poor people in the country than from the agricultural research workers whose major assignment is *supposed* to be the problems of rural areas.

It is not a crime for agricultural colleges to service per se large commercial farmers and energetic marketing firms. It should be the responsibility of our institutions to serve all people; they were created for exactly that purpose. The omission is in servicing the wealthier firms and families through activities with complex externalities which depress the income, employment opportunities, and institutions of other families and population strata in the same communities—then doing little about the latter.

Some lumbering changes are under way in research programs, but the total mix, in terms of man-years and budgets, has not deviated greatly from its conventional mold: more a program for consumers than for farmers as a group; more a program for large commercial farmers than for small marginal farmers or hired workers; more a program for the workers and firms near urban centers than for persons in small country towns replaced by the inputs processed by the former; or, more a spawner of technology than a solver of

social problems. While some of the problems of poverty and welfare have long existed and have been largely untouched, positively or negatively, by agricultural research, others have certainly been accentuated by the classical technical advances in farming.

Hightower and other recent critics are correct in these respects. It is not good strategy for colleges and universities to "claim it isn't true" and go about business as usual. In the long run, their funds stand to be greater and public support broader if they admit some inadequacies in programs and take more vigorous steps to remove them. The problem set, long ignored or treated so lightly by the majority of agricultural colleges, gives them and especially their social science departments a greater task to accomplish and a broader reach of society to which to relate. It gives, as compared to their conventional major activities, challenging problems of high marginal urgency to attack.

While Hightower's monograph hardly classifies as research, some of his main propositions are inverted and numerous economists have previously presented the same ideas with a systematic quantitative base [1, 5, 9, 13, 14]. But Hightower's methods and monograph certainly may do the system a favor in the long run. His accusations were newsworthy. They drew the attention and prompt response of governors, legislators, and public administrators who requested explanations from university administrations and who even posed questions to them such as, "Should we emphasize so much research to increase production when we pay farmers heavily to idle land and produce less?" Hightower's methods were much more effective than those of the agricultural economists who had previously analyzed and published the same results of agricultural research. But the agricultural economist's analysis was published in a professional journal (ours) under a long technical title and appropriately laced with footnotes. Consequently, communication largely was among professional economists. In contrast, Hightower, with a journalistic approach and some overstatements, got an immediate and broad public hearing.

Over the long run, institutions are likely to be better financed and gain broader public support if they concern themselves more with the people and problems of greatest social urgency. I propose that even the biological and physical fields, the historic and on-going major claimants on agricultural college budgets, will be better financed in the future if the economic and social problems

which their sciences indirectly help to create are adequately solved by a larger and more appropriate investment in the rural social sciences. These shifts in budgets are long overdue. The need is emphasized currently by reduced appropriations to some agricultural colleges; in the ability of the private sector to mount and implement large-scale research programs on applied technical phases of agriculture; and in the voices about us, including students and disadvantaged persons with their growing public sympathy, pressing for relevance of programs. It is still true that there are more programs for animals and things in our colleges of agriculture than for the people of rural communities. A sow has better available information from our institutions in guiding her to the best lot of opportunities in Chicago, Kansas City, or Omaha than does an underemployed housewife in farm areas. A bull calf will find more guidance information, indicating whether he should migrate to a feed lot in Arizona or to a breeding pen in Wyoming, than will the boy of a country town.

Role of Technical Advances

I am not engaging in blasphemy of an agricultural research and educational complex. I have previously gone on record supporting the notion that we do want advances in agricultural technology as a potential source of gain to consumers at large and for broad purposes of economic development [8, 10]. A strong program in technical and biological phases of research is needed for these reasons: (1) As a guarantee against uncertainty and contingencies surrounding long-run world control or management of population, food supplies, and the environment; (2) To help assure the competitive position of the U. S. in world markets and in leadership and ability to provide aid in world food and developmental problems; (3) Because even though demand for food is elastic, policies are possible which allow gain to consumers in lower real prices for food as resource requirements decline and simultaneously to farm producers if supply is controlled and managed appropriately; and (4) Because of large and broad general gains to society.

I recognize that it is not only technical change and related research by public agricultural institutions that cause unemployment and an inequitable distribution of gains and costs over rural areas and inflict penalties of reduced incomes, declining capital values, and weakened institutions over the countryside. Research by univer-

sities and firms in the private sector in areas quite unrelated to agriculture can generate impacts as great as those of agricultural institutions. This country's progress in economic development has produced a favorable real price of capital relative to labor which both induces more research on technologies and causes them to replace labor. These developments have also brought about changed demand patterns for services and commodities, placing a high premium on the skill and intellectual abilities of individuals but a low premium on their physical energies. These forces have widespread effects throughout the economy, and some of the most critical problems in cities result from these scientific and technical advances, which unfortunately only accentuate those problems with origins in the farm sector.

The negative spillover of research on rural areas is somewhat unique, however. It falls on people who are especially disadvantaged in education, spatially separated from labor markets, represented by a large number of females with meager employment opportunities and related phenomena. As a minimum compensation, these large and widely spread groups of rural communities, upon whom fall the real costs of rapid farm technological change, are owed as much research and guidance as goes into the research that erodes their economic opportunities and institutions through rapidly induced capital technologies leading to labor replacement, fewer farms, and large input-distributing establishments. Surely public agricultural institutions have an equal obligation to the people whose economic opportunities and social welfare they indirectly but surely diminish. But when these needs are pointed out, most institutions hurry to claim that they are shifting programs to the peoples' problems. If we examine the data, however, their professed urgency is not extremely convincing. A large percentage increase sounds commendable until we examine the small original base upon which it is calculated, plus the stability and upward absolute magnitude of research in the technical fields. Then, too, there is the process West [15] explains: First, in response to new needs or pressures, research institutions simply reclassify their research so that projects and manpower not previously in the problem set are now shown to be in it; next, other projects are relabeled, so that even though their previous titles said they were not in the problem area, the labels now say clearly that they are; finally, modest changes are made. Large public funds appropriated primarily

oriented toward economic and social problems have ended up in physical and biological projects labeled and classified to qualify for purposes of appropriations. An outstanding example was the large amount of Agricultural Marketing Act funds that ended up supporting conventional research in the biological and physical fields. A more recent example is the tendency for increments in rural development funds to be allocated to appropriately labeled physical and biological research that has only remote relationship to the "gut" economic and social problems of rural communities.

Opportunities under Development

Rather than camouflage conventional biological and physical research under rubrics to qualify them for public funds supplied to solve economic and social problems, public agricultural institutions now have an economic basis for reallocating funds not only to the "nonmarketable" problems of the technical sciences but also to the social sciences. The process of economic development in which land grant universities have played a great part allows this evolution. At low stages of development, as in the initiation of land grant universities, the major inputs of agriculture are land and labor. Aside from slavery, private firms cannot profitably produce and market these inputs. Under this input mix, with a small market for capital items the main technical improvements must come from publicly financed research. Hence, they conduct little research. However, as development occurs and inputs of the farming sector become mainly capital items, the market for farm capital items becomes large. A private firm can enhance its competitive position and enlarge demand for its capital inputs if it conducts research to make them more yield-productive and discovers innovations and materials of low real price. Any research which results in a product that can be boxed, bagged, and branded will be pursued by private firms. Much of the research conducted by agricultural colleges falls into the category of things which can be bagged and sold by private firms. This trend is reflected in the fact that private research expenditures for agriculture now exceed those of public institutions.

Hence, a certain set of public funds is released for research on problems caused by technological progress in agriculture, especially the problems of rural areas. Since the private sector will fill in and carry the one phase of research—particularly, applied aspects related to testing materials

with immediate yield increases—the public institutions have both a large and logical source of funds to be diverted to social and economic problems of rural areas. Rural area problems are those whose research results cannot be bagged and retailed by the private sector. They are especially the problems of the social sciences. However, there are also important problems in the biological and physical sciences that fall into this same category, for example, land use schemes and conservation, measurements and control of environmental degradation, aspects of fundamental research, certain problems in animal and human health and welfare, forestry on public lands, and others. The process of economic growth—causing the private sector to devote resources to research on agricultural phenomena which emerge as capital materials to be retailed in the market—automatically frees funds in public institutions for diversion to the urgent problems of people, their welfare, and their environment. The time is overdue for our institutions to do so much more fully.

I must emphasize that there are numerous administrators in our universities and agricultural colleges who well know that programs do not mesh with needs and who are concerned about the equity and humanitarian dimensions of research and educational activities. They would like to do more about remedying the externality effects of conventional programs and directly serving disadvantaged groups. But their degrees of freedom often are small under constant pressures from both outside interest groups and inside disciplines to maintain the historic mix.

The Role of Economists

Is the relative void in research on the publicly more urgent economic, social, and environmental problems entirely caused by institutional rigidities and both the intrauniversity political forces and outside pressures of special interest groups which prevail to maintain historic molds? Suppose that funds for agricultural economics, rural sociology, and related fields were doubled or quadrupled in the next five years. Would an intense crash program of research on the problems of poor people and the economically disarrayed rural communities be guaranteed? Probably not, because much of this work could already be done with the resources now available in rural social science fields. The amount of research and the number of people devoted to these types of problems are not really large. This condition evi-

dently prevails partly because of the interests and inclinations of economists, rather than entirely because of restraints placed on them by administrators. As Castle [4] indicates, agricultural economists have been a little more prone to consider the externalities involved in their research than have agronomists and engineers. There are, of course, states in which research on certain problems is taboo, particularly if it conflicts with economic and cultural interests of well-entrenched and politically powerful groups. Yet, there are just as many states in which these critical social problems could and should be researched as far as agricultural college administrators are concerned. Nothing prevents more research from being done on critical policies and decisions before the public or on urgent poverty and welfare problems. Administrators stand ready to back up the research worker's academic rights and social obligations in doing such research—if it is objective. They will defend him against pressures and attacks of those who prefer other results and reject those generated. While they may not be willing to divert funds from an agronomist or animal scientist to an economist, they will readily allow the latter to redirect his time and research funds from, for example, a more mechanical methodological project to one more related to the urgent problems of people. In these respects, the restraints are small, except for the interests and inclinations of the research worker. It obviously is true, as numerous writers in our journal have pointed out, that a large part of our profession (just as for personnel of other fields in our universities, a situation abetted by the deeply embedded administrative convention of salary and rank awards based on refereed scientific journal publications) looks upon its audience as one of scientific peers and perusers of the journals, rather than people concerned with real-world economic and social problems, and looks upon the public to whom it is responsible as being the scientific community. But why shouldn't these people do so, since the award system of universities not only claims the same but quantifies them by rank and salary advances?

There are other forces that also cause our profession to skirt problems of poverty, the disadvantaged, and those throughout rural communities who bear the major costs of technical transformations induced by the main-thrust research programs of agricultural colleges, and which cause us to concentrate on research better adapted to large commercial farms, the agribusiness sector and those generally better off. One force, of course, is the fact that the research or

extension worker can get a better audience from this group. Most specialists so inclined are, after all, human, wanting to accomplish something that will attract the attention of people and be put to use by them in solving their problems. Even if the extension specialist conducts a state educational program on the problems of poverty and related human needs, his participants likely will be higher income farmers and town leaders, rather than poor and unemployed people, coming to "find out what the problem is about."

This is not to say there has been no research by agricultural economists on problems of the poor, underemployed, and disadvantaged. Some in our profession have become well known for their excellent analyses of these problems and for outlines of policy to alleviate them. Too, some universities and colleges have concentrated programs on newly emphasized social and economic problems of rural areas and the environment. Yet, the amount of resources so devoted is small. There has been a rather large investment of manpower in analysis of policies for the commercial agricultural sector, but in comparison, relatively little has been invested for an equal number of small, low-income farms which gain most modestly from our conventional programs. Again, however, it is the large commercial farmer who will request the economist to make an analysis of farm policies and who will use it when completed. Seldom do the small, low-income farmers come knocking at the door with these requests. Again, in the face of human nature, the wheel which squeaks gets greased. It simply is true that the supply of knowledge to subsets of rural or farm-oriented population is a function of the expressed demand.

But there are other forces and tendencies that draw the majority of evenly applied quantitative research toward the larger and well-to-do of the farm and market sector. The nature, ease, and challenge of the analytical and quantitative tools undoubtedly do so, even apart from the activities of specialists engaged only in sharpening the tools. For example, in modern farm management or market efficiency studies, the set of operations research tools so well adapted to optimization problems leads more to technologies and investment opportunities. Actual consideration of polyperiod alternatives allows exercising the full potentials of the tools and challenges the analyst to construct and adapt them accordingly. Surely, the same tools apply to the resource-starved farm or firm which can see only as far ahead as the next year. But who wants to devise a mathemati-

cal programming analysis for which the capital restraint dominates all other resources, and choice reduces nearly to a "single line" of opportunities which can be solved by simple graphic means? To tackle such problems by such simple means, even though they relate to people for which the results have great meaning in economic security and utility, would not challenge the capacity of either the economist's mind or the campus computer. The major core of micro theory that graduate students study intensely as a foundation for their later work is in the direction of optimization by large, commercial, well-capitalized farms. One can qualify the first- and second-order conditions by an equation of capital restraints but then go ahead with research and a problem setting which more nearly assumes that this is not a very binding obstacle. The theory and quantitative tools relating to markets and their relationships probably also lead in a somewhat similar direction. The more powerful econometric methods probably are drawn more nearly to analyses wherein the underlying assumption or theory is that of optimizing firms attaining a state of equilibrium in an equilibrium market, and not of intervention with market relationships to alter the flow of income and employment among resource owners. Wide exercise of econometric tools based on time series observations probably leads more to analyses explaining "how things were" than to normative analyses explaining "how things ought to be." For these reasons they become conservative documents best relating to equilibrium of an unhindered market and thus to the people who traditionally gained most through it. Of course, purely statistical models can be melded with those of simulation and other types where experiments are conducted to examine outcomes under conditions other than an "untouched" competitive and equilibrium market. The applications are yet few and weak.

I do not discount or downgrade theory and empirical tools per se because, through the numerical capacity of computers, modern methods combining the two have greatly enhanced the ability of economists to tackle complex problems of scale and data complexities prevailing in the real world, whether they involve micro or macro-relationships. The power of these tools is great, and they are needed for the purposes of processing and surrounding the mass of data generally involved in an important applied economic problem. They allow the analyst to work on larger and more realistic systems, to tackle a given system with a more complete specification, or to

cover more problems in a given period of time. I do believe that our science as well as others has tended to become somewhat mechanistic, oriented first to the tools of the trade and second to the problem, and thus drawn to large organizations under the prevailing technology of research.

Analysts also become slaves to their tools, leading to a particular problem orientation, partly because the entire university system and its promotional or tenure criteria are similarly engulfed by a tool-journal complex of its own making. Safe strategy for quick migration from the assistant professor rank to tenure is rapid-fire publication of three methodological articles in a refereed journal, even though not a single soul may ever use the results. At the level of deans or higher university committees where the final decision of promotion is made, it is refereed journal publication which matters and not so much the content or relevance of the article. Hence, the agricultural economist who publishes two articles in the *German Annals of Mathematics* on "Procedures for Inverting an Upper Diagonal Matrix While Standing on One's Head" will have greater probability of promotion than will the person who uses the same time to solve six urgent problems and package them as mimeographed or popular publications passing immediately into the hands of users. The methodological article is preferred to the applied analysis because it has a greater probability, in the sense of qualifying for more outlets, as the quest is made for journal publication. While the effect here is no different from other sciences of the universities, it is true that agricultural economists are supposed to be concerned more with people and their problems than are mathematicians, plant breeders, and animal parasitologists. Yet, the university tenure-journal complex turns all of these people into a nearly equal mechanistic and non-people orientation. The payoff system in universities and in professional recognition is extremely important and dominant in determining how agricultural economists and other scientists allocate their efforts among problems.

Needs in Social Science

Agricultural economics claims the lion's share of funds appropriated to social sciences in agricultural colleges. Inputs to other social science fields are far too small relative to the nature, spread, and complexity of current problems extending over rural space. Personnel in rural sociology includes enough manpower to create a

critical mass in only a few states. A scattering of states also engages experts in legal affairs, political science, and family economics (other than traditional home economics). In terms of these scanty resources and the problems of all people in rural areas, if a shift were made in the concentration of resources between technical and social scientists in agricultural colleges, perhaps these fields should have claims prior to agricultural economics.

However, would more resources in social science fields other than economics guarantee more vigorous attacks on the problems of the poor, the disadvantaged, and the declining organizational and human milieu of rural areas? To guarantee this, some persons claim, as Hightower implies, that rural sociologists are concentrating too much on intricate methodological aspects of trivial problems in attempting to prove their true scientific prowess. It also is claimed that experts in legal affairs concentrate more on helping farmers with large estates devise corporate or other means to avert taxes and hold their capital together than in guiding low-income families, migrant workers, and the aged through the maze of mechanisms necessary to obtain small increments in welfare. Which is more important (and under whose weights), to help wealthy farmers develop family corporations to hold large estates together or to help hired workers form a labor union? Adoption models emphasized by sociologists have been more a mechanism for speeding innovations by large, alert farmers than in bringing up the tail of late adopters as they are being exercised by input-distributing firms in identifying the techniques and farmers through which new input forms can be spread most rapidly. More specifically, it appears that the work of political scientists has been more purely and continuously devoted to identification of the neglected in rural communities or in explaining why policy mechanisms come under the control of particular groups who reserve the benefits for themselves.

In general, the net record of other social scientists probably is no worse and may total somewhat better than that of economists in terms of research directed to people per se and the balance between the wealthy and the poor. Forces tending to concentrate research of other social sciences on problems of greatest importance in methodology and to wealthier groups are the same for economists: university promotion criteria giving dominant weight to journal publications, the urge accordingly to communicate mainly with scientific peers, and the avail-

ability of more responsive audiences in these realms.

Any university system could rectify this situation if it were brave and chose to do so. Perhaps it will take a new system to accomplish the same. Does the rapidly growing network of community colleges promise this possibility? So far they have been engaged only in education, with emphasis on that of practical importance to people seeking employment. Yet, the initial Rural Development Act of 1972 would qualify them for purposes of research on problems of rural areas. Does this indirect recognition pose the possibility that the public will eventually turn to other centers of knowledge closer to communities and their people, letting the land grant institution concentrate entirely on worship of the professional journal and the rituals of its own scientific community? Could the professional consulting firm, with addition of a little more octane, a longer adherence to the problem, a wider communication of results, and some public subsidy, come to serve in a better way the land grant institution's original role as a mechanism of all the people?

Perhaps the main need is to bring the hierarchies of control and endeavors in land grant universities into vertical synchronization. It is not unusual to hear presidents lament the difficulty in getting their middle management to shift programs in urgent new directions; to hear deans discuss the restraints in moving their departments and staffs to more relevant emphases; and to hear staff members describe the things they would do for people if their administrators would allow it. It seems extremely difficult for these different segments, expressing unanimity of desire, to attain a successful vertical docking. Thank heavens, none of them have been recruited for the space program! Perhaps a major means of tackling urgent problems of people is an emphasis in administrative structure other than the basic mold and control mechanisms of discipline. Over time the tendency has been for disciplines to dig deeper moats around themselves and to retreat further into their departmental bastions; while physically adjacent, their deepened discipline barriers prevent simultaneous attacks by departments on the major facets of relevant problems. In fact, furtherance of the discipline typically is taken as more important than the solution of people's problems. This situation could be changed by administrative structures that give problem sets as much control over university resources as the disciplines now have. Administrative control could be viewed in the context of a

matrix where the rows are problem sets and the columns are disciplines. Each would have as much control over the elements under its various columns as a column has over the elements of the rows beneath it. Not only are the needs great, but also the possibilities in administration are many.

Opportunity for Professional Organization

An interesting question to be posed to a professional organization such as the American Agricultural Economics Association, whose members supposedly are supported by the public to treat certain applied problems in economics and related social science, is this: Does it have a challenge? Is it the responsibility or the role of such a professional organization to evaluate the effectiveness with which the land grant universities and colleges of agriculture are tackling the economic and social problems of the rural sector? In light not only of claims such as those by Hightower but also those by an increasing number of intelligent persons, could it evaluate the extent to which the net effect of research and educational programs of these institutions is positive or negative over the total rural economy? Could it, with the wealth of quantitative materials available, evaluate the distribution of benefits and costs, market and nonmarket, among all groups affected by this research and education? Then, could it establish changes in programming of research needed in the agricultural colleges, especially between the physical and social sciences, to eliminate the most negative of these impacts or to guarantee at least a Pareto optimum of total results?

There is basis for doubt that the mix of biological-physical and social science research maintained in agricultural colleges over the last two decades and into the present one (considering the amount of biological-physical research now generated by the private sector) is consistent with the shift of major problems of the farm and rural community sectors to economic and social poles. As part of the agricultural college complex and as experts in allocative principles and objective function maximization, does the agricultural economics profession have a role in assessing these allocations and suggesting the relative weight the social sciences should have? Would such an assessment help move land grant universities nearer a program appropriate to today's dominating economic and social problems of rural

areas? Why have agricultural economists become so conscious and verbal about equity and distribution problems generated by new farm technologies in international development—so much so that donor organizations are now beginning to modify their programs accordingly—but as a body are extremely hushed about the research and educational programs of the institutions and states in which they live?

In recent years most universities have had to listen to the voices of activist groups. Even aside from the more extreme and violent set, activist groups have included students concerned about the orientations of universities and the extent to which they are mechanistically rather than people oriented. University administrators have listened to these groups—out of fear in some cases but in realization that students' claims of programs lacking dimensions of humanism had some foundation. Universities also seem to listen and respond some to on-campus dissident professors who sometimes borrow the tactics and strategies of the students. From the sum effect of these forces, our universities are in a rather rapid evolution of new approaches to education, curriculum content, participation of students in policy, and even life styles of liquid consumption, dormitory living, and cohabitation. Now, could or should a professional organization such as ours be just a tiny bit or even fractionally or minutely revolutionary to the extent of appointing a committee to evaluate the manner and extent to which conventional allocation and promotional procedures of land grant universities and colleges of agriculture restrain and successfully block more vigorous attacks on the urgent people-oriented economic and social problems of rural areas and related sectors? (I use the people-oriented qualification because economic and sociological research can be as highly sophisticated but equally as mechanistic and as little humanitarian as nuclear physics research.) Or, the Association might join the rural sociologists and the small band of political scientists interested in rural affairs in developing this analysis and set of recommendations. Such a committee might suggest a weighting scheme based on the relevance of peoples' problems in applied fields, such as the rural social sciences, which purportedly are financed by the public for these specific reasons.

Such an activity would certainly benefit agricultural colleges over the long run. It could show them how to maintain their public support by tackling urgent problems of relevance to people.

Without a greater move in this direction and under continuation of great supply capacity of agriculture, bred by capable research in the private sector and the basic sciences, the colleges face either an absolute limit or diminution in their support. But in a more vigorous attack on the urgent problems of people in rural areas, they could have a broader and more challenging opportunity than has ever been theirs. They must decide between accepting this challenge or withering away over the next two decades in tandem with declining farm numbers and rural population. I hope they accept the challenge, because our universities need at least one college which is heavily dedicated to and engaged in the problems of people and in related research and education. The agricultural college still has the best tradition for this purpose. Perhaps now its name should be changed to the "college of rural human affairs" [3] in contrast to some of the more mechanistic changes (such as "the school of natural resources," "the college of food and fiber") now under way. Those applied sciences most concerned with people and their problems should lead the way in this rebirth and redirection. The basic problem is one of allocation. Economists are specialists in allocation problems and should be better able to make an evaluation of agricultural college allocations than administrators, the majority of whom are not specialists in allocative principles. Coming from professional organizations, the evaluation would carry much more weight than an occasional article by an individual. The revolutionary and coercive flavor would be much less than that of student activists and

dissident professors to whom university administrations do listen and respond.

My focus, in this day of growing public concern over problems of equity and questions on the relevance of university and college programs, has been (a) how our institutions can be encouraged or brought to allocate a greater proportion of resources to sciences dealing with humanitarian and equity problems, and (b) how these resources in the social sciences might be brought to bear more effectively on the problems of all people in rural areas. Having stated my propositions, I hurry to claim that the profession of agricultural economics has, among all physical and social sciences, a much better score than most others in these respects. It has been scientifically productive, quick in applying new methodologies to the observations of the real world, and generally anxious to generate findings for an audience which is known to exist. Still, people are coming to count more in: the purposes of sciences, the objectives of government, the importance of people over things, and even whether and by how much public institutions will be supported. Agricultural economics needs both to be given greater opportunity in these humanitarian orientations and to make better use of resources when they are given opportunity.

My propositions, while perhaps not entirely new, are aggregated together here in hopes of restimulating and forwarding the dialogue to improve the functioning in public service. My intentions are positive. Now, I await the tomatoes; perhaps soft red ones here and hard amber ones later.

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Sectional Meeting G

THE ECONOMICS OF ZERO GROWTH

CHAIRMAN: FRED H. ABEL, ENVIRONMENTAL PROTECTION AGENCY

In Defense of a Steady-State Economy

HERMAN E. DALY

THE case against continuous exponential growth in the physical coordinates of our economy has already been made [1, 2, 5, 7, 8, 9, 10, 14, 15, 16, 24] but has not yet won majority acceptance. Rather than repeat the arguments establishing the necessity and desirability of a steady-state economy, I will confine myself to a critique of a number of counter-arguments and objections which have been raised against the steady-state view by those who remain committed to the orthodox growth paradigm. What follows then is a kind of catechism of pro-growth fallacies, sophistries, casuistries, obfuscations, nonsequiturs, question-beggings, and misunderstandings, which, if properly refuted, should indirectly make the case for a steady-state economy.

Confusions and Obfuscations Arising from Vague Definitions and the Substitution of Connotations for Denotations

These misunderstandings are too numerous to catalog and arise mainly from the unhappy term "zero growth," which many people interpret as implying an end to all technical and moral progress, an absolute, relative, and eternal static freeze. The verb "to grow" has become so overlaid with positive value connotations that we have forgotten its first literal dictionary denotation, "to spring up and develop to maturity." Thus, the very notion of growth includes some concept of maturity at which point physical accumulation gives way to a steady state. Thus, "steady state" is a more descriptive term than "zero growth," although both imply the essential cessation of gross physical accumulation.

The steady-state economy is a *physical* concept. It is defined by constant stocks of people and physical wealth (artifacts) maintained at some chosen, desirable level by a low rate of throughput. The throughput flow begins with de-

pletion (followed by production and consumption) and ends with an equal amount of waste effluent or pollution. The throughput is the maintenance cost of the stock and should be minimized for any given stock size, subject to some limits stemming from the legitimate need for novelty.¹ The psychic dimension of wealth, i.e., its want-satisfying capacity, may forever increase due to increasing knowledge and technical improvement. But the physical dimensions are limited. It is obvious that in a finite world nothing physical can grow forever. Yet, real GNP is a value *index* of *quantity* produced. It is overwhelmingly an index of physical throughput. Our current policy is to make this flow grow, although it is clearly more in the nature of a cost than a benefit. Benefits come from the services rendered by the stock of wealth. This service or want satisfaction, or psychic income is unmeasurable, but it is clearly related to the stock, not the flow. The flow merely serves to maintain the stock and is a necessary cost. One cannot ride to town on the maintenance flow of the stock of automobiles but only in an existing automobile that is a current member of the stock. Nor, as Georgescu-Roegen points out, can one cross a river on the annual maintenance flow of a bridge. To maximize the throughput flow for its own sake is absurd. To maximize the inflow end of throughput for the sake of a larger stock is a limited process, and the limits are physical. The stock and its associated throughput are limited by space, by the mass of the earth, by heat release, and far more stringently by the intricate web of ecological relationships which too large a throughput will rip to shreds. Moral and social limits, though less definable, are likely to be even more stringent. For example, the social problem of safeguarding plutonium from immoral uses and consequences is more likely to limit breeder reactor

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¹ The lower the throughput the longer lived is the stock of wealth. Conceivably, commodities could last too long, though that hardly seems to be an immediate danger.

usage than is the physical constraint of thermal pollution. The steady state will be socially desirable long before it becomes an immediate physical necessity.

Unfortunately, economists long ago forgot about physical dimensions and concentrated their attention on value.² Value is measured in money. Money, as a unit of account, has no physical dimension. A sum on deposit at Chase Manhattan Bank can grow forever at 5 percent! Income and wealth are value concepts; they too are measured in money; why cannot they too grow forever at 5 percent? Money fetishism triumphs completely! The concrete reality being measured is reduced to identity with the abstract unit of measure. The physical dimensions of wealth are "annihilated" by the Almighty Dollar! But in fact wealth always has a physical dimension. Even knowledge requires physical organisms with brains, calories to run the brain, and light for the transmission of information. Knowledge can increase the ability of the stock to satisfy wants, perhaps without limit. Knowledge can, within limits set by the second law of thermodynamics, reduce the flow throughput per unit of stock maintained.

Once we have attained a steady state at some level of population and wealth, we are not forever frozen at that level. As values and technology evolve we may find that a different level is both possible and desirable. But the growth (or decline) required to get to the new level is a temporary adjustment process, not a norm. Presently, the momentum of growth in population and capital pushes our technological and moral development. In the steady-state paradigm, technological and moral evolution would precede and lead growth instead of being pushed. Growth would always be seen as a temporary passage from one steady state to another, not as the norm of a "healthy" economy.

Can't Get Enough of That Wonderful Stuff

The American people have been told by no less an authority than the President's Council of Economic Advisors that, "If it is agreed that economic output is a good thing it follows by definition that there is not enough of it" [20, p. 92]. It is impossible to have too much of a good thing. If rain is a good thing, a torrential downpour is "by definition" better! Has the learned council

forgotten about diminishing marginal utility and increasing marginal costs? A charitable interpretation would be that "economic" output means output for which marginal utility is greater than marginal cost. But it is clear from the context that what is meant is simply real GNP. But perhaps this amazing nonsequitur was just a slip of the pen. At another point in the same document [20, p. 88] the council admits that "growth of GNP has its costs, and beyond some point they are not worth paying." But instead of raising the obvious question—What determines the optimal point and how do we know when we have reached it?—the council relapses into nonsequitur and quickly closes this dangerous line of thinking with the following pontification: "... the existing propensities of the population and policies of the government constitute claims upon GNP itself that can only be satisfied by rapid economic growth." Apparently, these "existing propensities and policies" are beyond discussion. This is growthmania.

The theoretical answer to the avoided question is clear to any economist. Growth in GNP should cease when decreasing marginal benefits become equal to increasing marginal costs. But there is no statistical series which attempts to measure the cost of GNP. This is growthmania—literally not counting the costs of growth. But the situation is even worse. We take the real costs of increasing GNP as measured by the defensive expenditures incurred to protect ourselves from the *unwanted* side effects of production and *add* these expenditures to GNP rather than subtract them. We count real costs as benefits. This is hyper-growthmania. Obviously, we should keep separate accounts of costs and benefits. But to do this would make it clear that beyond some point zero growth would be optimal, at least in the short run. Such an admission is inconvenient to the ideology of growth, which quite transcends the ordinary logic of elementary economics. More precisely, it is good growthmanship strategy to admit the theoretical existence of such a point way out in the future, but somehow it must always be thought of as far away. The ideological reasons for this are clear and have to do with the problem of distribution of output in an economy in which ownership of land and capital is highly concentrated and embodies labor-saving technology. Full employment at a living wage requires high aggregate demand, which requires high net investment to offset the large savings made possible by concentrated income. High net investment signifies rapid growth.

² Fortunately, this is less true for agricultural economists, who have always kept at least one foot in the real biophysical world.

The Hair of the Dog That Bit You

One of the most popular arguments against limiting growth is that we need more growth in order to be rich enough to afford the costs of cleaning up pollution and discovering new resources. Economist Neil Jacoby says, "A rising GNP will enable the nation more easily to bear the costs of eliminating pollution" [12, p. 42].

Yale economist Henry Wallich makes a similar point,

The environment will also be better taken care of if the economy grows. Nothing could cut more dangerously into the resources that must be devoted to the Great Cleanup than an attempt to limit resources available for consumption. By ignoring the prohibitionist impulse and allowing everybody to have more, we shall also have more resources to do the environmental job. [23, p. 62]

No one can deny that if we had more resources and were truly richer, all our economic problems would be more easily solved. The question is whether further growth in GNP will *in fact* make us richer. It may well make us poorer. How do we know that it will not, since we do not bother to measure the costs and even count many real costs as benefits? These critics simply assume that a rising per capita GNP is making us better off, when that is the very question at issue!

Even if marginal welfare benefits of GNP were presently greater than marginal welfare costs, we know that the curves will eventually cross as growth continues. Of course, the benefit curve could shift up and the cost curve shift down due to changes in tastes and technology, and the intersection would occur at a higher GNP. But even ignoring the possibility that the curves could also shift in the opposite directions, and assuming *very unrealistically* that the benefit curve will forever shift upwards and the cost curve downward, there is *still* the question of timing. Why must the curves always shift *before* we reach the intersection? Might not technical progress occasionally be delayed? Might we not find it optimal to cease growth temporarily while waiting for the curves to shift? Or must we go beyond the optimum, just to keep up the momentum of growth for the sake of avoiding unemployment? Once we have gone beyond the optimum and marginal costs exceed marginal benefits, growth will make us worse off. Will we then cease growing? On the contrary, our experience of diminished well-being will be blamed on the

traditional heavy hand of product scarcity, and the only way the orthodox paradigm knows to deal with increased scarcity is to advocate increased growth—this will make us even less well off and will lead to the advocacy of still more growth! Sometimes one suspects that we are already on this "other side of the looking glass" where images are inverted and the faster one runs the "behinder" one gets.

Environmental degradation is an iatrogenic disease induced by the economic physicians who attempt to treat the basic sickness of unlimited wants by prescribing unlimited production. One does not cure a treatment-induced disease by increasing the treatment dosage! Yet, members of the hair-of-the-dog-that-bit-you school who reason that it is impossible to have too much of a good thing can hardly cope with such subtleties. If an overdose of medicine is making one sick, one needs an emetic, not more of the medicine. Physician, heal thyself . . . !

Consistent Inconsistencies and Avoiding the Main Issue

Growthmen are forever claiming that neither they nor any other economist worth his salt has ever confused GNP with welfare. Consider, however, the following four statements from the same article [17]:

(1) "Gross National Product is not a measure of economic welfare and its maximization is not a proper objective of economic policy. Economists all know that. . ." (p. 6)

(2) "Although GNP and other national income aggregates are imperfect measures of welfare, the broad picture of secular progress which they convey remains after correction of their most obvious deficiencies." (p. 25)

(3) "But for all its shortcomings, national output is about the only broadly-based index of economic welfare that has been constructed." (p. 1, Appendix A)

(4) ". . . there is no evidence to support the claim that welfare has grown less rapidly than NNP. Rather NNP seems to underestimate the gain in welfare, chiefly because of the omission of leisure from consumption. Subject to the limitations of the estimates we conclude that the economic welfare of the average American has been growing at a rate which doubles every thirty years." (p. 12)

It is asking too much of context and intervening qualification to reconcile statement (1) with statements (2), (3), and (4). Either GNP (or NNP) *is* an index of welfare, or it is *not*. The

authors clearly believe that it is (in spite of the first statement). They offer many sensible adjustments to make GNP a better measure of welfare on the assumption that it is already an imperfect measure. But all of this avoids the fundamental objection that the GNP-flow is basically a *cost*. Wants are satisfied by the services of the *stock* of wealth. The annual production flow is the *cost* of maintaining the stock and, though necessary, should be minimized for any given stock level. If we want the stock to grow we must pay the added cost of a greater production flow (more depletion, more labor, and ultimately more pollution). Depletion, labor, and pollution are real costs which vary directly with the GNP-throughput. If we must have some indices of welfare, why not take total stock per capita and the ratio of total stock to throughput flow? Welfare varies directly with the stock, inversely with the flow. Beyond some point the benefits of additions to the stock will not be worth the costs in terms of additional maintenance throughout.

Kenneth Boulding has for many years been making the point that Gross National Product is really Gross National Cost and has never been taken seriously. If this way of looking at things is wrong, why does not some economist deal it a decisive refutation instead of avoiding it? Certainly it is not a minor issue.

The source of this flow-fetishism of orthodox economics is two-fold. First, it is a natural concomitance of early stages of ecological succession. Young ecosystems (and cowboy economies) tend to maximize production efficiency, i.e., the ratio of annual flow of biomass produced to the pre-existing biomass stock that produced it. Mature ecosystems (and spaceman economies) tend to maximize the inverse ratio of existing biomass stock to annual biomass flow. The latter ratio increases as maintenance efficiency increases. Economic theory is lagging behind ecological succession. The other reason for flow fetishism is ideological. Concentrating on flows takes attention away from the very unequally distributed stock that is the real source of economic power. The income flow is unequally distributed also, but at least everyone gets some part of it, and marginal productivity theory makes it appear rather fair. Redistribution of income is liberal. Redistribution of wealth is radical. Politically, it is safer to keep income at the center of analysis. Not everyone owns a piece of the productive stock and there is no theory explaining wealth distribution.

Putting stocks at the center of analysis might raise impolite questions.

Crocodile Tears from Latter-Day Marie Antoinettes

Economists and businessmen with no previous record of concern for the poor have now begun to attack steady-state advocates as upper-class bird-watchers, who, having gotten theirs, now want to kick the ladder down behind them and leave the poor forever on the ground floor. There may be such people and certainly they should be condemned. But most advocates of the steady state accept and proclaim the absolute necessity of radical redistribution of wealth as well as income. Indeed, many people who have long favored less inequality in the distribution of wealth on ethical and political grounds are only too happy to reach the same conclusion on ecological grounds. It is the orthodox growthmen who want to avoid the distribution issue. As Yale economist Henry C. Wallich [23] so bluntly put it in defending growth, "Growth is a substitute for equality of income. So long as there is growth there is hope, and that makes large income differentials tolerable." We are addicted to growth because we are addicted to large inequalities in income and wealth. What about the poor? Let them eat growth! Better yet, let them feed on the hope of eating growth in the future!

We have been growing for some time and still have poverty. It should be obvious that what grows is the reinvested surplus, and the benefits of growth go to the owners of the surplus, who are not poor. Some of the growth dividends trickle down but not much. The poor are given the sop of full employment—i.e., they are allowed to share fully in the economy's toil but not in its dividends—and unless we have enough growth to satisfy the dividend recipients even the booby prize of full employment is taken away.

On the issue of growth and poverty Joan Robinson noted that,

Not only subjective poverty is never overcome by growth, but absolute poverty is increased by it. Growth requires technical progress and technical progress alters the composition of the labor force, making more places for educated workers and fewer for uneducated, but opportunities to acquire qualifications are kept (with a few exceptions for exceptional talents) for those families who have them already. [21, p. 7]

Admitting the Thin Edge of a Big Wedge

"We know that population growth cannot continue forever" [17, p. 20]. This apparently innocent commonplace is the thin edge of a wedge whose thick end is capable of cracking the growth orthodoxy in half. This results from the fact that in addition to the population of human bodies (endosomatic capital), we must also consider the population of extensions of the human body (exosomatic capital). Cars and bicycles extend man's legs, buildings and clothes extend his skin, telephones extend his ears and voice, libraries and computers extend his brain, etc. Both endosomatic and exosomatic capital are necessary for the maintenance and enjoyment of life. Both are physical open systems that maintain themselves in a kind of steady state by continually importing low entropy matter-energy from the environment and exporting high entropy matter-energy back to the environment. In other words, both populations require a physical throughput for short-run maintenance and long-run replacement of deaths by births. The two populations depend upon the environment in essentially the same way. The same biophysical constraints that limit the population of organisms apply with equal force to the population of extensions of organisms. If the first limitation is admitted, how can the second be denied?

Misplaced Concreteness and Technological Salvation

Technology is the rock upon which the growthmen built their church. Since rocks and foundations are concrete entities, it is natural that growthmen should begin to endow technology with a certain metaphorical concreteness, i.e., to begin speaking of it as a *thing* which *grows* in *quantity*. Then, it is but a short step to ask whether this "thing" has grown exponentially like many other things and to consult the black art of econometrics and discover that indeed it has! Next, one can conceive of technology as a sort of antibody to the pollution and the depletion germs. Then, one concludes that depleting and polluting activities (production and consumption) can continue to grow exponentially because we have a problem-solving, anti-particle technology which can also grow exponentially!

Is the above an unfair caricature? Consider the following quote from a review of *Limits to Growth* by two economists and a lawyer:

While the team's world model hypothesizes exponential growth for industrial and agricultural needs, it places arbitrary, nonexponential, limits on the technical progress that might accommodate these needs.

... It is true that exponential growth cannot go on forever if technology does not keep up—and if that is the case we might save ourselves much misery by stopping before we reach the limits. But there is no particular criterion beyond myopia on which to base that speculation. Malthus was wrong; food capacity has kept up with population. While no one knows for certain, technical progress shows no signs of slowing down. The best econometric estimates suggest that it is indeed growing exponentially. [19, p. 12]

These few sentences are very valuable in that they unite in one short space so many of the misconceptions of orthodox growthmen. Note that technology has become an exponentially growing *quantity* of some *thing* which solves problems but does not create any. Note the clear implication that exponential growth could go on forever if technology (that problem-solving anti-particle) can keep up. Can it in fact keep up? Consult the entrails of a nameless econometrician and, behold—it has in the past, so it probably will in the future. Most econometricians are more cautious in view of the fact that technical change cannot be directly measured but is merely the unexplained residual in their regressions after they have included as many measurable factors and dummy variables as they can think of. Sometimes the residual "technology" component even includes the effect of increased raw material inputs! Note also the blind assertion that Malthus was wrong, when in fact his predictions have been painfully verified by the majority of mankind. But then majorities have never counted. Only the articulate, technically competent minority counts. But even for them Malthus was not really wrong, since this minority has heeded his advice and limited its reproduction.

A far more perceptive reviewer of *Limits to Growth* has noted a similar confusion and lucidly comments on it in the following quote:

Some critics of "Limits" berate the authors for not including exponentially growing technical knowledge as a sixth constituent of the World Model. Such criticism elaborately misses the point. The other five constituents have real, physical referents that can be quantified: population can be counted, barrels of petroleum con-

sumed can be enumerated and parts per million of abrasive chemicals in the smog of Los Angeles can be measured.

Sheer "knowledge" means nothing for the world system until it enters one of the other five constituents, and the tacit assumption that all technical knowledge necessarily enters as a good is unwarranted. Is the technical knowledge that performance of gasoline engines can be improved by adding tetraethyl lead to their fuel a "good"? [22, p. 42]

In other words, the MIT projections of physical growth trends already include the effects of past technical "progress" as these effects were registered in the five physical referents of the model. The tacit assumption is that the influence of technology on the physical world will in the future change in ways similar to the way it has changed in the past. One need not accept *Limits to Growth* in its entirety, but it is clear that whether or not technology has "grown exponentially" is largely irrelevant. The assumption of some critics that technical change is totally a part of the solution and no part of the problem is ridiculous on the face of it and totally demolished by the work of Barry Commoner [3]. One need not accept Commoner's extreme emphasis on the importance of the problem-causing nature of post-World War II technology (with the consequent downplaying of the roles of population and affluence) in order to recognize that recent technical change is more a part of the problem than of the solution. The key question is: What kind of technology is part of the solution and what kind of institutional sieve will let pass the good kind while blocking the bad kind?

Two-Factor Models with Free Resources and Funds That Are Nearly Perfect Substitutes for Flows

Economists routinely measure the productivity of the fund factors, labor, and capital (and Ricardian land). But the productivity of the flow factors, natural raw materials, and inanimate energy are seldom even spoken of, much less calculated. This reflects a tacit presumption that they are not really scarce, that they are the free and inexhaustible gifts of nature. The only limit to the flow of product is assumed to be the capacity of the fund factors to process the inputs and turn them into products. Tobin and Nordhaus are specific on this point:

The prevailing standard model of growth assumes that there are no limits on the feasibility of expanding the supplies of nonhuman agents of production. It is basically a two-factor model

in which production depends only on labor and reproducible capital. [17, p. 14]

How is this neglect of resource flows justified? According to Nordhaus and Tobin, "the tacit justification has been that reproducible capital is a near perfect substitute for land and other exhaustible resources." If factors are near perfect substitutes, then there is of course no point in considering them separate factors. From the point of view of economic analysis they are identical. But it is very odd to have such an identity between factors whose very dimensionality is different. Capital is a fund, material and energy resources are flows. The fund *processes* the flow and is the *instrument* for transforming the flow. The two are obviously complements in any given technology. But allowing for technological change does not alter the relationship. The usual reason for expanding or redesigning the capital fund is to process a *larger*, not a smaller flow of resources. New technology embodied in new capital may also permit one to process *different* materials, but this is the substitution of one resource flow for another, not the substitution of a capital fund for a resource flow.³ After we deplete one resource we redesign our machines and set about depleting another. The assumption is that in the aggregate resources are infinite, that when one flow dries up there will always be another, and that technology will always find cheap ways to exploit the next resource. When the whales are gone, we will hunt dolphins, and so on till we are farming plankton. The ecologists tell us that it will not work, that there are other limits involved, and even if it would work, who wants it? But Professors Nordhaus and Tobin see little connection between economic growth and ecological catastrophe—"As for the danger of global ecological catastrophe, there is probably very little that economics can say" [17, p. 20]. As long as economic growth models continue to assume away vast domains of material scarcity this is quite true and is simply another way of saying that current growth economics has uncoupled itself

³ Nordhaus and Tobin [17] state that the "tacit assumption of environmentalists is that no substitutes are available for natural resources." They consider this an extreme position, but what substitute is there for natural resources? They offer "reproducible capital," but in addition to requiring natural resources for its very reproduction, capital funds are clearly complements to resource flows, not substitutes. The fact that one resource flow may substitute for another, if the capital fund is redesigned to allow it, is no basis for saying that the generic factor of capital is a substitute for the generic factor natural resource!

from the world and has become irrelevant. Worse, it has become a blind guide. But it need not remain so.

But Resources Are Such a Small Percentage of GNP

Perhaps another "justification" for ignoring resources is the small value component of GNP which they represent. In 1968 total minerals production represented 1.7 percent of GNP and total fossil fuels 2.0 percent [11, p. 15].⁴ Why is it that our price system imputes such a small share of total value produced to resources and such a large share (the remainder) to labor and capital? Does this vindicate the assumption that resources are ultimately not scarce? Or does it simply mean that they are underpriced? I believe the latter is the case, and that this underpricing results from the relative power of social classes that conditions the functioning of the market. Specifically, labor and capital are two powerful social classes, while resource owners for good reasons are not. Let us see how this rigs the market in favor of low resource prices.

In the short run we have a given technology and given amounts of the fund factors, labor, and capital. It takes time to change the capital stock and to change the size of the working-age population. Suppose it is desired to increase the incomes of both capital and labor in the short run. Since the incomes of capital and labor are tied to their respective productivities it becomes necessary to increase these productivities. Under short-run assumptions the only way to increase the productivities of both fund factors is to increase the flow factors of raw materials and power. As the flow of resource throughput is increased with a given fund of labor and capital, the productivity of the resource flow must, by the law of diminishing returns, decrease. All three productivities cannot increase in the short run. It is clear that the flow factor's productivity is the one most likely to be sacrificed, since in the short run it is the only one whose quantity can

be increased. But furthermore, even in the longer run with all factors variable but no technical change, it is clear that resource productivity will also lose out. The tie between labor productivity and labor income, plus the monopoly power of labor unions, will keep labor productivity from being sacrificed. The tie between capital productivity and interest and profit, along with the monopoly power of large corporations, will keep capital productivity from being sacrificed. Capital and labor are the two social classes that produce and divide up the firm's product. They are in basic conflict but must live together. They minimize conflict by growth and by throwing the growth-induced burden of diminishing returns onto resource productivity. How do they get away with it? In earlier times it might not have worked; a strong landlord class would have had an interest in keeping resource prices from falling too low. But today we have no such class to exert countervailing upward pressure on resource prices. Although resource owners do exist and they do prefer higher to lower prices, other things equal, it remains true that no social class is as effective in promoting resource productivity as the capitalists and laborers are in promoting the productivities of their respective factors.

Suppose we allow for technological change in the long run. Now it is possible for all three productivities to increase. But how likely is it? Given the desire to increase incomes of labor and capital, it seems innovations that increase these two productivities will have first priority, while those that mainly increase resource productivity will not be stimulated. Given low prices for resources it will not matter much to entrepreneurs what happens to resource productivity. And surely it is easier to invent a new technology that increases the productivity of two factors than to invent one that increases all three productivities.

Should we, by a kind of reverse land reform, reinstate a landlord class? Landlord rent is unearned income, and we find income based on ownership of that which no one produced to be ethically distasteful. No one loves a landlord. Adam Smith tells us that landlords love to reap where they have never sown, and not many lament the historical demise of the landowning aristocracy. But not all the long-run consequences of this demise are favorable. Rent may be an illegitimate source of income, but it is a totally legitimate and necessary price, without which efficient allocation of scarce resources would be impossible. Henry George said, let rent be charged but then tax it away. Socialists, after trying to get

⁴ The "optimistic" conclusion of this paper is that "assuming reasonable management practices and adaptations, the remaining mineral resource base of the *earth* is sufficient to maintain the *present state* of material affluence of the *United States*, and to share it to *some meaningful degree* with the rest of the world, for at least the next hundred years" [11, p. 1] (my italics). In other words, if we move rapidly and efficiently to a steady-state at present levels, and draw on all the world's resources, and limit our sharing with the rest of the world to some "meaningful degree," our system could continue for the next hundred years! Such "optimism" makes pessimism redundant.

along without the price, say charge some rent but pay it to the government, who is now the landlord. In the USA neither of these things has happened. The largest resource owner, the government, has followed a give-away and low price policy, both on resources it owns and on those whose price it regulates (e.g., natural gas). It has done this to favor certain capitalists, to promote growth, and to ease the labor-capital conflict and win votes in both camps.

Also imports of resources from underdeveloped countries, which have not yet learned how to use them, have naturally been cheap because of the low short-run opportunity cost to the exporting country. This is now changing, but in the past it has been a factor in keeping resource prices low. Some resources are owned by capitalists, but they are likely to be much more interested in maximizing growth and minimizing conflict through low resource prices than in making profits on sales of resources. In fact, the capitalist's ownership of resources will generally be for the purpose of lowering the cost price of those resources to himself as capitalist, in order to increase the returns to capital. Capital is the dynamic, controlling factor. It is not for nothing that our economic system is called "capitalism" rather than "resource-ism."

Let us consider briefly two similar analyses of resource productivity.

Karl Marx had the following to say regarding the effect of capitalist production on soil productivity:

Capitalist production . . . disturbs the circulation of matter between man and the soil, i.e. prevents the return to the soil of its elements consumed by man in the form of food and clothing; it therefore violates conditions necessary to the lasting fertility of the soil. . . . Moreover, all progress in capitalistic agriculture is a progress in the art, not only of robbing the laborer, but of robbing the soil; all progress in increasing the fertility of the soil for a given time is a progress toward ruining the lasting sources of that fertility. The more a country starts its development on the foundation of modern industry, like the United States, for example, the more rapid is the process of destruction! Capitalist production, therefore, develops technology, and the combining together of various processes into a social whole, only by sapping the original sources of all wealth—soil and the laborer. [13, pp. 505–506]

Marx sees capitalists exploiting the soil as well as the laborer. Our analysis sees capital and labor maintaining an uneasy alliance by shifting the

exploitation to the soil and other natural resources. It follows that if some institution were to play the role of the landlord class and raise resource prices, the labor-capital conflict would again become severe; hence the radical implications of the ecological crisis and hence the need for some distributist institution.

A more recent analysis of resource productivity, in the case of electric power, was made by Barry Commoner [4]. He found the productivity of electric power to be falling in all individual industries considered and falling even more in the total economy as power-intensive industries displaced other industries in relative importance. His empirical findings suggest to him an

. . . apparently unavoidable dilemma created by an effort to reduce overall power demanded by industrial production: either total production is curtailed, or power productivity is elevated; but if the latter course is taken, labor productivity must be reduced.⁵ Thus, whichever course is taken, the effort to reduce power demand would appear to clash head on with one or both of the two factors that are widely regarded as essential to the stability of the United States economic system—increased production and increased labor productivity.

These considerations raise the possibility—which it is to be hoped economists will investigate—that continued exponential increase in power consumption is not an accidental concomitant of industrial growth, but is rather a functional necessity for the continued operation of the United States economic system, as it is presently organized. If this should prove to be true, then the ultimate social choice signified by the power crisis becomes very stark. One course is to continue the present exponential growth in the supply of electric power, and risk our future on the ability to contain the huge mass of resultant chemical, radioactive, and thermal pollution. The other is to slow down the rate of power consumption, and accept as a necessary consequence that the economic system must be changed. [4, p. 31]

The social class relative power hypothesis presented as an explanation of low resource prices and productivities might be considered as a theoretical complement to Commoner's empirically based generalizations and conjectures. Social conflict is minimized in the short run by low productivity of the entire throughput, which is a consequence of high productivity (and incomes)

⁵ This is apparently an empirical generalization by Commoner, based on an observed inverse relationship between power productivity and labor productivity during the period 1946–1968 (see [4, Fig. 3]).

for labor and capital. If one opts to avoid the risk of containing large masses of material, chemical, thermal, and radioactive pollution, not to mention aesthetic, moral, and social costs, one must limit growth in throughput. What is the most efficient and least painful way to limit throughput?⁶

Present Value and Positive Feedback

It is sometimes argued that the market automatically provides for conservation by offering high profits to farsighted spectators who buy up materials and resell them later at a higher price. There are at least two things wrong with this argument. First, exponentially growing extraction leads to "unexpectedly" sudden exhaustion. If the doubling time of the cumulative total amount extracted is on the order of 30 years, as it apparently is for many resources, then we would go from a condition of one-half depleted to totally depleted in the final 30-year period. Most resource owners probably find that surprising. For linear trends the past is a good guide to the future. For exponential growth the past is a deceptive guide to the future. The second problem is that the future profit must be discounted to its present value. The investor has the alternative in an expanding economy of depleting now and investing the short-term profits in another line that will earn the expected "going rate" which will be close to the growth rate of the economy. The discount rate he applies to future profit is the same as the rate at which he would expect his reinvested short-term profits to grow. This expected rate is determined largely by the current rate and by recent changes in the current rate. The result is that high and increasing current growth rates, based on high and increasing current depletion rates, lead to high and increasing discount rates applied to future values. The latter in turn leads to a low incentive to conserve, which feeds back to high current depletion and growth rates, high discount rates, etc. Present value calculations thus have an element of positive feedback which is destabilizing from the point of view of conservation. "Financial prudence" usually advises one to deplete now and invest his short-term earnings in depleting some other resource, etc. The presumption again is infinite resources. There will always be more material and energy resources available to feed the march of compound interest

with its consequent discounting of future values and disincentive to conservation.⁷

Youth Culture and Its Fear of Gerontocracy

A stationary population is a part of a steady-state economy. Assuming present mortality rates, the attainment of a stationary population would imply an increase in the average age of the population from the current 27 to about 37 years. This raises fears of social senility, excessive conservatism, loss of adaptability and dynamism, etc. This hardly seems a reasonable fear, even for devotees of the "Pepsi generation." One need only compare Sweden, with one of the oldest age structures, to, say, Brazil with one of the youngest. It would certainly be stretching things a bit to say that old Sweden is a reactionary, non-innovative gerontocracy, while young Brazil is a progressive, innovative country run by young people. One might just as well argue that Brazil values youth less than Sweden because its infant mortality rates are higher, and therefore Sweden is more youth-oriented than Brazil. Such arguments are *simpliste* at best.

Frustrated Pyramid Climbers

The stationary population "pyramid" would be shaped more like a house (rectangular up to

⁷ This tacit assumption sometimes becomes explicit, as in the following quotation from Samuel H. Ordway, president of a great oil company:

... the fact seems to be that the first [resource] storehouse in which man found himself was only one of a series. As he used up what was piled in that first room, he found he could fashion a key to open a door into a much larger room. And as he used up the contents of this larger room, he discovered there was another room beyond, larger still. The room in which we stand at the middle of the twentieth century is so vast that its walls are beyond sight. Yet it is probably still quite near the beginning of the whole series of storehouses. It is not inconceivable that the entire globe—earth, ocean and air—represents raw material for mankind to utilize with more and more ingenuity and skill. [18, p. 28]

The above is also the assumption of orthodox growth economics. Even if this vision were correct, one should add that eventually we must *live* in the same rooms we work in. Living in intimate contact with garbage and noxious wastes is a by-product of growth. But then, optimists will argue that there is another infinite series of ever larger garbage dumps! The whole conceptual basis of the growth faith is equivalent to a generalization of the chain-letter swindle. There will always be five new resources for every depleted resource. The current beneficiaries of the swindle, those at the beginning of the chain, try hard to keep up the illusion among those doubters out at the end who are beginning to wonder if there are really sufficient people or resources in the world for the game to continue very much longer.

⁶ Elsewhere I have argued for a system of depletion quotas auctioned by the government as the basic institution, with effluent taxes as a fine-tuning supplement. See [6].

about age 50, where the roof begins and rapidly tapers to a peak). But the structure of authority in hierarchical organizations remains a pyramid. Thus, there would in the future be less of a congruence between advancing age and advancing position. More people would grow older at lower levels of authority, and many ambitions would be frustrated.

The observation is a highly interesting one, and no doubt has important sociological implications. But they are not all negative by any means. More individuals will learn to seek personal fulfillment outside of hierarchical organizations. Within such organizations fewer people will be automatically promoted to their level of incompetence, thus thwarting the so far relentless working of the Peter Principle. Perhaps giant bureaucracies will even begin to dissolve and life will reorganize on a more human scale.

Pascal's Wager Revisited

The growthmania position rests on the hypothesis that technical change can become entirely

problem solving and not at all problem creating and can continually perform successively more impressive encores as resources are depleted. There is sufficient evidence to make reasonable men quite doubtful about this hypothesis. Yet, it cannot be definitely disproved. There is a certain amount of faith involved, and faith is risky. Let us then take a completely agnostic position and apply the logic of Pascal's Wager and statistical decision theory. We can err in two ways: we can accept the omnipotent technology hypothesis and then discover that it is false, or we can reject it and later discover that it is true. Which error do we most wish to avoid? If we accept the false hypothesis, the result will be catastrophic. If we reject the true hypothesis, we will forego marginal satisfactions and will have to learn to share, which, though difficult, might well be good for us. If we later discover that the hypothesis is true we could always resume growth. Thus, even in the agnostic case it would seem prudent to reject the omnipotent technology hypothesis, along with its corollary that reproducible capital is a near perfect substitute for resources.

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The Implications of Zero Growth for Agricultural Commodity Demand

WILLIAM J. SEROW

THE relatively recent concern over problems of man's numbers and his environment has led to official endorsement of the concept of a stationary (i.e., non-growing) population by the President's Commission on Population Growth and the American Future [7]. Some 35 to 40 years ago there was also interest in the problem of stationarity in the United States, Europe, and other areas, although much of the focus was on potential economic problems that this situation would, in the opinion of some writers, create.¹

The purpose of this paper is to examine some consequences of a stationary population, particularly in the sphere of demand for agricultural commodities. The first section reviews demographic consequences of a stationary population; the following section attempts to measure the economic consequences of this state of affairs. The third section treats the problem of changes in agricultural commodity demand resulting from both the diminution in the growth rate of population and the changing age structure of the population that will result as the condition of stationarity is approached.

Demographic Implications of a Stationary Population

If fertility were to fall, in any nation, to a level of bare replacement and remain there indefinitely, the population in question would continue to grow for an extended period into the future. This is due to the fact that the age distribution at the time of the fertility decline is, in all probability, substantially different from what the stationary age distribution of the population will eventually be. It should be recalled that the age

distribution of any population at any point in time is a reflection of that population's previous history of fertility and mortality [6, 15].

There is an infinite number of courses a population could follow to arrive at stable-stationary level (or zero population growth). Many of the more plausible courses have been analyzed by Frejka [10, 11]. However this state is achieved, the attainment of a stable-stationary population will result in a significant shift in the age composition of the United States. As is indicated below (Table 1), the median age of the United States in 1970 was 27.9 years. About 38 percent of the population was under age 20 and 14.1 percent was over age 60. By the end of the century, if the population continues to increase at about the current level, median age would rise to 30.7 years, with 33.9 percent under age 20 and 13.4 percent over age 60. If, however, fertility were to decline to the replacement level (2.11 children born per woman) and net immigration is zero, the median age would be 33.4 years, with 30.6 percent of the population under age 20 and 14.7 percent over age 60. When a state of zero population growth is finally achieved (under these assumptions, about the year 2040), median age of the population would be 37.3 years, with 27.0 percent of the population under age 20 and 21.5 percent over age 60.²

Income Effects of Stationarity and Effect Upon Food Purchases

To estimate a possible income impact of the diminution of population growth concomitant with the approach of stationarity, we have employed a very rudimentary economic model which includes population size and composition as endogenous variables.³ The simplicity of this model is such that its adequacy for realistic forecasting for a complex economy such as the United States is rather doubtful, but an application for merely illustrative purposes should be

² These are the Series D and Series X projections of the U. S. Bureau of the Census. See [28, pp. 33-55].

³ This is essentially the model developed by the General Electric Company—TEMPO for the Agency for International Development (see [12]). A somewhat more sophisticated model that also treats population variables as endogenous is found in Lloyd [17].

¹ For example, Robbins [22], Cannan [4], Neisser [20], Hansen [13], Keynes [16], Myrdal [19], Staudinger [27], and of particular interest here, Baker [1]. The concept of stationarity, of course, goes back even beyond this. Book IV of J. S. Mill's *Principles of Political Economy* [18] deals extensively with the possible outcome of stationarity of population, capital, and the "arts of production." Cannan, writing in 1895 [5], foresaw that the population of England and Wales might become stationary during the present century.

Table 1. Percentage age distribution of the U. S. population under alternative patterns of population growth, 1970-2020

Year	0-4	5-9	10-14	15-19	20-34	35-54	55-59	60+	Median age	Total Population (millions)
1970	8.39	9.71	10.16	9.42	20.73	22.65	4.88	14.07	27.9	204.8
Series D										
1980	9.85	8.59	7.58	8.74	25.09	20.75	4.89	14.50	28.6	230.9
1990	9.24	9.42	8.83	7.72	22.77	23.64	3.93	14.44	30.1	260.8
2000	8.61	8.24	8.45	8.62	21.38	26.82	4.42	13.45	30.7	288.3
2020	8.35	8.26	8.17	7.77	21.17	24.38	5.31	16.59	32.4	351.3
Series X										
1980	8.97	8.31	7.66	8.86	25.35	20.97	5.01	14.89	29.1	223.3
1990	8.24	8.54	8.24	7.64	23.51	24.41	4.11	15.32	31.3	241.8
2000	7.45	7.40	7.75	8.03	21.42	28.56	4.72	14.66	33.4	255.7
2020	6.93	7.05	7.13	6.99	20.36	25.83	6.16	19.53	36.1	279.5
Ultimate	6.78	6.76	6.75	6.73	19.98	25.58	5.88	21.52	37.3	—

Source: U. S. Bureau of the Census [28].

acceptable. The point of the above is that application of the model to two hypothetical situations equal in all respects save the growth rate of population (and, hence, of the labor force) eventually permits recognition of the possible economic impact of differing rates of population growth. (The basic equations of such a model are given in the appendix).

Because of the changing age composition of a population approaching the stationary level, that is, the ratio of producer to nonproducer will rise, there is likely to be a higher level of income per head in the more slowly growing population. This appears to be reasonable on *a priori* grounds

since with population growth more potential capital expansion must be channeled into providing for the support of temporarily nonproductive segments of the population and, as Spengler has noted, perhaps reduce "... the rate at which a given absolute rate of capital formation can increase per capita equipment, since capital must be spread over more people" [25, p. 114].⁴

By application of the simple demographic economic model outlined in the appendix to two pos-

⁴On the other hand, Spengler [25, p. 116] also notes that the Keynes-Hansen thesis of secular stagnation holds that diminution of investment due to a tapering off of population growth leads to increasing underemployment.

Table 2. Household population, number of households, and income characteristics based upon alternative population projections of the United States, 1960-2000

	Year	Household Population (millions)	Households (millions)	Total Income (billions of constant dollars)	Income per household
Population	1960	179.3	53.0	\$ 503.7	\$ 9,500
Approaching the stationary level	1965	187.1	55.1	591.1	10,700
	1970	196.2	60.2	686.9	11,400
	1975	204.7	65.8	800.6	12,200
	1980	212.0	69.2	947.1	13,700
	1985	219.5	71.7	1,138.8	15,900
	1990	226.5	73.2	1,337.2	18,300
	1995	232.7	75.2	1,565.9	20,800
	2000	238.3	77.0	1,840.9	\$23,900
U. S. Census	1960	179.3	53.0	503.7	\$ 9,500
Series D	1965	194.6	57.2	591.1	10,300
	1970	203.2	62.4	686.0	11,000
	1975	215.6	69.3	831.5	12,000
	1980	227.5	74.3	974.1	13,100
	1985	240.9	78.6	1,202.5	15,300
	1990	254.7	82.3	1,421.8	17,300
	1995	268.0	86.6	1,675.9	19,400
	2000	280.7	90.8	1,961.8	\$21,600

Source: Serow [24].

sible patterns of population growth for the United States, we are able to evaluate the possible impact of stationarity upon the level of per capita income [24]. Table 2 shows the projected number of households, population size, total income, and per household income from 1960 to 2000 for: (a) a projection which assumes linear fertility decline to replacement over a 20-year period and (b) the Bureau of the Census Series D projections. The major point of interest in the table is that under the assumed conditions of stationarity and the economic assumptions underlying the model employed, per household income will be somewhat higher with a population approaching stationarity than with a slowly growing population.

Per household demand for agricultural products under these two demographic situations will be dependent, to some extent, upon the elasticity of demand for these products with respect to income. Among recent studies on income elasticity there are two of particular interest in this regard: Purcell and Raunika's study of quantity-income elasticities for foods [21] and Harmston and Hino's study of intertemporal changes in "taste" [14]. The former study indicated that from 1958 to 1962 elasticity of demand was positive for all household income levels from \$3,000 to \$10,000 for the following commodities: ice cream, baking mixes, beef, lettuce, whole milk, tomatoes, citrus fruits, buns and cakes, oils, nuts, bananas, fish and seafood, poultry, and non-citrus fruits. The elasticity, which ranged from 0.44 to 0.12, suggests that demand per consuming unit (household) would increase with increases in real income. For beverages (except milk and alcoholic beverages) and bread, the elasticity of demand was positive at lower income levels but turned negative somewhere between \$7,000 and \$10,000. For pork, corn, eggs, green-yellow vegetables, and green beans, the nature of the elasticity changed between income levels of \$5,000 and \$7,000, and for sugar the relationship changed between \$3,000 and \$5,000. Finally, elasticity of demand was negative at all income levels for the following commodities: green leafy vegetables, white potatoes, margarine, cabbage, dry beans, sweet potatoes, canned milk, fats, buttermilk, and flour and meal.

The study by Harmston and Hino [14] was concerned with not only the level of elasticity by household income (\$3,000 and \$15,000) but also intertemporal and interincome changes in the nature of elasticities. For example, a good might be superior (elasticity greater than zero) at both

income levels but if the elasticity is greater at higher incomes, it may also be called preferred. Thus, a preferred superior good is one with positive elasticity which tends to increase with the level of income. Products that are classified by Harmston and Hino as preferred superior for 1965 include alcoholic beverages, beef, butter, cheese, cream, dried fruit, fresh fruit, fresh vegetables, frozen foods, frozen milk products, bakery products (non-bread), peanut butter and "snacks," poultry, soft drinks, veal and lamb, mixtures (such as baby food), and salad oils. Superior but nonpreferred goods (those with positive elasticity but lower at high incomes) include coffee, eggs, fresh milk, pork, soups, canned goods, premium flour, and cold breakfast cereals. Inferior goods include margarine, potatoes, other grain products (rice, noodles, etc.), bread, tea, grits, dried vegetables, flour, hot breakfast cereals, processed milk, and shortening.

Although there is no perfect correlation between these lists, there is enough similarity to conclude that per capita demand for some products should rise with the level of income and at an increasing rate. Generally, these would include most meats (except pork), fresh fruit, dairy products (except milk), and convenience foods. Other products, particularly grains and substitute goods (for example, margarine), would most probably diminish in terms of per capita demand. The only product for which there was a real discrepancy between the two studies was vegetables, which were inferior (at least at high incomes) in the Purcell and Raunika study but preferred superior in that of Harmston and Hino.⁵

The question now is whether the higher per capita income generated by the projection assuming eventual population stationarity is sufficiently large to offset the relative decline in numbers. Additionally, the value of the elasticity varies from commodity to commodity, so the overall income effect varies from commodity to commodity. To illustrate possible effects, assume that per household and total demand for two products (beef and margarine) is equal to 100. On the average, according to Harmston and Hino's data for 1965, the income elasticity of beef increases by .018 for each \$1,000 of household income and that of margarine decreases by .014 for each \$1,000 of household income. Utilizing these as-

⁵ This may be due to the differences in universe involved. The Purcell-Raunika study was based upon a panel of consumers in the Atlanta area, while the Harmston-Hino study was based on U. S. Department of Agriculture data.

Table 3. Indices of aggregate and per household consumption of beef and margarine under alternative demographic-economic projections

	Year	Beef		Margarine	
		Per Household	Aggregate	Per Household	Aggregate
Population	1960	100	100	100	100
Approaching stationarity	1965	102.16	106.21	98.82	102.73
	1970	103.42	117.46	98.12	111.44
	1975	104.86	130.18	97.34	120.85
	1980	107.56	140.44	95.86	125.16
	1985	111.56	150.92	93.69	126.74
	1990	115.84	159.99	91.32	126.12
	1995	120.34	170.75	88.86	126.08
	2000	125.92	182.94	85.80	124.65
Series D	1960	100	100	100	100
	1965	101.44	109.47	99.21	107.07
	1970	102.70	120.92	98.52	116.00
	1975	104.50	136.63	97.54	127.54
	1980	106.48	149.27	96.45	135.21
	1985	110.44	163.78	94.28	139.82
	1990	114.04	177.08	92.31	143.34
	1995	117.82	192.52	90.24	147.95
	2000	121.78	208.63	88.07	150.88

sumptions and the data from Table 2, we can develop these indices which are presented in Table 3. The per household index is simply 100 plus net income change times the appropriate elasticity, while the aggregate index is the product of the per capita index and the relative increase in the number of households. This procedure can obviously be used only to a certain extent. The assumption that changes in elasticities are constant for all increments of income is obviously weak, since for a superior good there is some point at which no more of a commodity will be purchased, no matter how high the level of income, and there is some point, perhaps zero, below which demand will not fall for an inferior good or one which Harmston and Hino would call superior non-preferred.⁶

Data in Table 3 show that under the postulated conditions aggregate demand would increase at a slower overall rate for both commodities with a population approaching the stationary level than in the case of a continually growing population. Yet, for the superior good (beef) per household demand is higher in the stationary case due to the higher level of income. For the

inferior good (margarine), the converse is true for the same reason. In general, as long as one population is conducive to a higher level of per capita or per household income than another, per capita or per household demand for superior goods will tend to be higher in the first case than in the second. For inferior goods per capita demand will tend to be less in the case of higher income. Thus, under a stationary population the aggregate consumption of an inferior good such as margarine would be less than in a growing population. For a superior good such as beef the relative values of aggregate demand would depend upon the magnitude of the elasticity and the growth rates of population and income in the alternative situations.

Impact of a Stationary Population upon Age Composition and Effect upon Food Purchase

As noted in Table 1, the advent of a stationary population would alter the age distribution of the United States to a considerable extent. The precise impact in the short run, with which we are concerned, depends primarily upon the nature of the fertility assumptions employed. All such projections entail a considerable aging of the population, but the effect is more pronounced in a shorter period of time with a more abrupt fertility decline.

Changes in the age composition of population

⁶ Burk [3, p. 124] notes that, "At successively higher levels of average real income, the rate of increase in food expenditures may be expected to show that 26 percent of per capita income in 1929 (\$861) was spent on food, compared to 21 percent of per capita income in 1959 (\$1,461)." (Both income figures in 1947-49 dollars.) See also Burk's later article [2] and Ferber [8].

will affect aggregate demand for agricultural commodities to the extent that per capita demand is a function of age. Fox [9] does provide recommended daily calorie and protein allowances from which we might be able to draw inferences upon the pattern of aggregate demand. Although these allowances may be dated, it seems probable that the relative differences among requirements for various age groups are more or less constant. The requirements by age are given in Table 4.

The impact of changes in the age composition of a population upon aggregate demand for commodities would then depend upon the nature of these changes. An application of the data in Table 4 to the age composition of the Series D and the Series X projections (see Table 1) shows that in the year 2000 per capita recommended allowances for calories would be on the order of 2,375 for Series D and 2,390 for Series X. The level of protein allowances would be nearly identical—61.28 per capita for Series D and 61.30 grams for Series X. However, the difference in size of these projected populations is such (32.6 million by the year 2000) that the total calorie allowance for the Series D population, 684.7 billion calories per day, would be 12.0 percent greater than that of the Series X projection (611.2 billion calories per day). This difference would be reflected in a difference in aggregate demand for all agricultural commodities.

Of somewhat greater importance than aggregate caloric and protein requirements is the impact of a changing age composition upon the aggregate demand for selected commodity groups. Data from 1965 which show average food intake by age (per person per day) are presented in Table 5. There are 12 commodity categories; the intake pattern by age tends to vary somewhat among them. For example, daily intake of milk

and milk products is at a maximum in the first year of life (795 grams) and declines consistently thereafter, so that for persons aged 75 and over average daily intake is only 258 grams. On the other hand, intake of non-milk beverages (coffee, tea, soft drinks, alcoholic beverages) is very low (6 grams) in the first year of life but rises quite sharply, especially from age 15, to a maximum of 877 grams per person per day for ages between 35 and 54. For an aging population, it would seem apparent that demand for non-milk beverages would grow at a somewhat greater rate than the demand for milk and milk products.

This result is confirmed by data in Table 6 which presents estimates of aggregate demand for all 12 commodity groups expressed as an index number relative to estimated 1970 intake. By presenting the data in this fashion, we need not assume that 1965 levels of consumption by age remain constant but only that the relative differences among age groups remain constant. Data are presented for the years 1980, 1990, and 2000 for both the Series D projection and the population approaching the stationary level. (The age distributions of these projections were presented in Table 1.)

There are several things of note about the data in Table 6. First, aggregate demand in the steadily growing population exceeds that of the population approaching stationarity for each commodity group and at each point in time. Second, the age distribution changes of both projections are such that the relative changes in demand among commodity groups would be quite similar in both cases. In both the steadily increasing case and the case of the population approaching stationarity, demand would increase relatively more for non-milk beverages than for any other commodity group. Other commodity groups which would grow faster than demand for all products through the year 2000 are meats and eggs and (for the stationary case) dark green and yellow vegetables. The other commodity groups, namely, fats and oils, white potatoes, tomatoes and citrus fruits, other vegetables and fruits, grain products (baked goods), sugar and sweets, legumes and nuts, and milk and milk products, would increase in demand at lesser rates. The latter commodity group would grow at a significantly slower rate than any other group.

The final column of Table 6 relates aggregate demand in each commodity group in the year 2000 for the steadily growing population to the corresponding value for the population approach-

Table 4. Recommended daily dietary allowances of calories (number) and protein (grams) by age, United States, 1953

Age	Calories	Proteins
0-4	1000	40
5-9	1800	55
10-14	2600	75
15-19	3000	85
20-34	2800	60
35-54	2500	60
55+	2200	60

Source: Fox [9].

Table 5. Food intake per day, by age, United States, 1965

Age	Milk, Milk Products	Eggs	Meat Poultry Fish	Legumes Nuts	Fats, Oils	Grain Products	Tomatoes Citrus Fruits	Vegetables Dark Green Yellow	White Potatoes	Other Fruit, Vegetables	Sugar, Sweets	Beverages (non-milk)
	(in grams)											
0	795	17	49	13	2	21	23	14	6	164	10	6
1-2	645	28	104	16	12	58	60	9	34	150	30	88
3-5	566	23	127	28	18	80	66	10	43	151	43	149
6-8	602	23	157	36	22	94	75	12	53	171	47	185
9-11	610	26	172	34	25	105	88	12	56	200	52	216
12-14	619	27	202	38	30	115	94	14	62	199	56	290
15-17	576	34	230	38	31	113	95	15	72	200	50	408
18-19	513	33	247	31	35	112	91	13	72	182	44	507
20-34	333	41	270	32	32	101	96	15	76	178	39	837
35-54	276	41	247	23	31	96	101	16	63	198	39	877
55-64	260	42	231	21	29	89	102	18	60	201	40	765
65-74	264	41	189	14	24	85	94	19	60	190	38	627
75+	258	33	174	10	23	83	82	17	56	185	33	530

Source: U. S. Department of Agriculture [29, pp. 582-583].

ing the stationary level. Considering all commodity groups, aggregate demand would rise about 10 to 11 percent less in the population approaching the stationary level than in the steadily growing case. For individual commodities the difference ranges from 8 to 9 percent for non-milk beverages to 13 to 14 percent for milk and milk products.

Summary and Conclusions

This study finds that the effects of a stationary population upon demand for food products may be determined by at least two factors: prospective changes in income level and prospective changes in the age composition of population. If a stationary population has a favorable impact upon the level of per capita income, which in the short run is likely due to the more favorable age composition of the population, then per capita

demand for food is apt to rise, although perhaps at a declining rate. For goods with a positive income elasticity this is also the case; inferior goods, that is, those with negative income elasticity, would probably decline in terms of per capita demand. The impact upon aggregate demand for any and all commodities would depend upon the relative movements of income and population size.

Additionally, the older age composition of the population approaching stationarity should tend to raise per capita calorie and protein requirements and, hence, per capita demand for food products. However, the relative differences would appear to be small compared to differences in population size. The expected changes in the age distribution affect different commodities in different ways, depending upon sensitivity of demand for the commodity to an aging of the population. Demand for those commodity groups, notably

Table 6. Aggregate consumption of selected commodity groups under alternative demographic assumptions, 1970-2000

(index numbers) (1970 = 100)

	1970	Series D			Series X			Series X-2000
		1980	1990	2000	1980	1990	2000	Series D-2000
Milk and milk products	100.0	111.0	123.5	136.9	106.4	113.9	118.0	.8619
Eggs	100.0	113.8	127.0	142.6	110.6	120.0	128.1	.8984
Meat, poultry, fish	100.0	113.3	126.5	142.2	110.3	119.4	127.4	.8962
Legumes, nuts	100.0	111.5	124.3	138.3	107.9	115.9	121.1	.8759
Fats, oils	100.0	112.2	125.7	141.4	109.3	118.5	126.5	.8944
Grain products	100.0	111.6	125.1	140.2	108.3	117.5	124.5	.8881
Tomatoes, citrus fruits	100.0	112.1	125.8	141.2	109.0	118.5	126.3	.8944
Dark green and deep yellow vegetables	100.0	112.8	126.3	141.5	109.6	119.0	126.9	.8966
Other vegetables and fruit	100.0	111.9	125.6	140.8	108.4	117.8	125.3	.8902
Sugars, sweets	100.0	110.7	124.3	138.9	107.3	116.4	122.7	.8838
Non-milk beverages	100.0	115.0	128.9	146.1	112.5	122.9	133.4	.9134
White potatoes	100.0	113.1	126.1	141.1	110.0	118.0	125.9	.8926
Total	100.0	112.9	126.3	141.8	109.6	118.8	126.6	.8928

milk and milk products, which are heavily consumed by the young, is likely to increase at a much lower rate than commodities more heavily consumed by older members of the population (non-milk beverages, meat, eggs).

The advent of a stationary population will tend to create an older and wealthier population than would otherwise be the case. Both of these factors are likely to influence demand for commodities. Increased income would probably increase per capita demand for all commodities, particularly those of a convenience or luxury nature.⁷ A relatively larger number of older persons in the population would tend to shift demand towards commodities especially consumed by them. In general, it would appear that these effects are reinforcing.

There are, however, several limitations to the foregoing analysis. Assumptions of constancy of tastes and similar variables come to mind quickly. Additionally, there has been no consideration of important factors such as family size, level of urbanization, technological change, and regional differences [2, p. 619]. Furthermore, the longer-range implications of stationarity, particularly the problem of inadequate aggregate demand and subsequent stagnation of the economy, feared by Keynes, Hansen, and others have not been considered. Other longer-range factors sometimes hypothesized about a stationary population, such as increasing conservatism and consequent impact upon technological change, have likewise been neglected.

More serious than the foregoing is the failure to consider the supply side of the basic equation or to speculate on the impact of stationarity upon the price of given commodities and, in turn, the impact of price upon demand. Spengler [26] has recently demonstrated that the advent of a stationary or very slowly growing population will be conducive to upward pressure on prices under present conditions. Still, considering these and all other omissions which have not been mentioned, the foregoing might shed some light on at least the probable consequences of zero growth in the agricultural sphere and hopefully lead the way to the development of policies appropriate for these consequences.

⁷ Ruttan [23, p. 707] notes, "... in relatively high-income economies the income elasticity of demand for commodities and services related to sustenance is low and declines as income continues to rise. ..."

APPENDIX

Basic Equations of the Demographic-Economic Model

Total Population for any sex-race group at time t is:

$$(1) \quad P_t = \sum_{i=0}^{80} P_{i,t}$$

where $P_{i,t}$ is the total mid-year population in the country for any age-sex race group at time t . $P_{i,t}$ is:⁸

(2.1) Where $i=0$:

$$P_{i,t} = \left[\sum_{j=15}^{49} F_j(S_j P_{j,t-1}) \right] (1 + M_i),$$

F_j is the effective (i.e., inclusive of probability of nonsurvival after birth to the mid-year) age-sex-race specific fertility rate; $S_j P_{j,t-1}$ is the number of surviving women (of the appropriate race) who were aged j at the midpoint of the previous year; M_i is the appropriate net immigration rate for this age-sex-race group.

(2.2) Where $i=1, \dots, 80$:

$$P_{i,t} = (S_i P_{i-1,t-1})(1 + M_i),$$

where S_i is the probability of surviving from age $i-1$ to age i ; $P_{i-1,t-1}$ is the number of persons in the country aged $i-1$ in the previous year; and M_i is again the appropriate net immigration rate.

(2.3) Where $i=81$: $P_{i,t}=0$.

That is, all who survive to age 80 are assumed to die before their 81st birthday.

The labor force, L_t , is⁹:

$$(3) \quad L_t = \sum_{i=15}^{64} (P_{i,t} P_i),$$

where P_i is the labor force participation rate

⁸ Essentially, this is a set of second-order difference equations not unlike a Markov chain done in an iterative fashion. That is, population, P_t , is multiplied by the set of survival and reproductive probabilities to yield P_{t+1} . In our model the survival probabilities would be constant, but the reproductive probabilities would change in various ways, as suggested by the text. Once the set of probabilities reached the replacement level, they too would remain constant. It should be noted that the replacement level (Net Reproduction Rate equal to 1) is solely dependent upon the set of probabilities, not the age structure of the population in question.

⁹ The following equations are adaptations of those in [12].

appropriate to the age-sex-race group under consideration. The number of consumers $P_{s,t}$ is:

$$(4) \quad P_{s,t} = \sum_{i=0}^{80} E_i [P_{i,t}],$$

where E_i is a weight arbitrarily chosen to reflect changing consumption patterns at various ages; for example, for $i=0, \dots, 19$, E may equal .5; for $i=20, \dots, 59$, E may equal 1.0; for $i=65, \dots, 80$, E may equal .75.

Consumption, C_t , is

$$(5) \quad C_t = C_1 Y_t + [C_2 (Y_t/P_{s,t})] P_{s,t},$$

where C_2 is a parameter reflecting the propensity to consume, a function of both the distribution of the set of consumers, $P_{s,t}$ (with differing propensities to consume and patterns of consumption) and total income; C_1 is the propensity for public expenditure and may be regarded as a constant.

Investment, I_t , is

$$(6) \quad I_t = Y_t - C_t$$

and capital stock, K_t , is

$$(7) \quad K_t = K_{t-1} + I_t + FI_t,$$

where K_{t-1} is last year's stock and FI_t is net inflow of capital.

Employment, N_t , is

$$(8) \quad N_t = \left(1 + g \frac{\Delta K_t}{K_{t-1}}\right) N_{t-1},$$

that is, 1 plus some proportion (g) of the change in capital stock times the previous year's employment. (g) in turn is a function of the previous year's unemployment (i.e., $1 - N_{t-1}/L_{t-1}$) relative to the initial unemployment level ($1 - N_0/L_0$). This proportion will be assumed to approach zero as population growth (and unemployment) approaches zero.

Finally, Gross National Product, Y_t , is

$$(9) \quad Y_t = AK^u N^v K_{t-1} N_{t-1},$$

where A is a factor reflecting the level of technology and equal to: $(9a) A = Z(1+Q)^t$, where Z is the initial level of technology and Q is the annual rate of technical progress; u and v represent the fractional change in output resulting from a given change in inputs K or N , respectively. For example, if $u=.7$, an increase of \$1 in K input will cause output to rise by 70¢. Alternatively, u and v may be thought of as the fraction of income accruing to K or N , respectively.

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The Effects of Zero Population Growth on the Spatial Distribution of Economic Activity*

GEORGE L. BRINKMAN

THE condition of zero population growth is achieved when the number of new births and immigrants equals the number of deaths and emigrants. This condition, also referred to as a stationary population, eventually may be necessary to prevent excessive depletion of our resources and overcrowding, even though it does not imply zero economic growth. The rapid decline in birth rates in the United States in recent years—from 3.65 in 1960 to only 2.41 in 1969—lends support to the possibility of achieving such a condition.

In this paper I concentrate on the general trends in distribution of economic activity that I think are most likely to occur under zero population growth, with no attempt to provide specific coefficients for the amount of economic development that could occur under the many variables and assumptions that influence either economic or population growth. This paper is divided into two sections. In the first, which concerns the conceptual framework, I clarify assumptions about the eventual size and distribution of our population under zero population growth; examine changes in aggregate demand and investment to show the impact of a stationary population on economic growth; and finally discuss relationships among population, economic activity, and such exogenous forces as technology, tastes, international trade, and government programs. In the second section, I summarize the anticipated trends in the distribution of economic activity among geographic regions and various sized cities. This analysis is undertaken for both market forces and government policies. Little previous work has been published on economic distribution under a stationary population, so this section is speculative. I hope my hypotheses will stimulate follow-up research.

A Conceptual Framework

Population size and distribution under zero population growth

The condition of zero population growth in all

probability could not occur in the United States for at least several decades. Our present birth rates are in excess of replacement needs, and a large number of young people already born will be entering child-bearing age within that time. Also, because our current population has more young people than old, we can expect more births than deaths for several decades, even at a two-child-per-family birth rate. Consequently, some and possibly considerable population growth will occur before we can achieve a stationary size. Knowing that population size and distribution affect economic activity, a crucial question now is: How much growth can we expect and what population distribution will accompany that growth? The effects from a stationary population of 250 million people, for example, likely would be quite different from those of a final population size of 500 to 700 million people.

In working on this paper, I have examined various assumptions about birth rates and about the time needed to adjust to zero population growth that could affect the final population size and distribution. My analysis is undertaken with the assumption that the condition of zero population growth would be achieved through a gradual reduction of birth rates and would occur in the first half of the next century, when population size would be about 250 to 300 million people. That assumption roughly approximates the population numbers of Series X of the Census Bureau, which assumes a replacement birth rate from now on (2.11 children per family) with no immigration, resulting in a stationary population of 276 million in the year 2037. Larger final population sizes of 350 or 400 million or more could occur before zero population growth begins, if high birth rates should persist for several decades before tapering off to replacement levels. Projections for two- and three-child families illustrate how large our population could become [1]. Under present rates of immigration (400,000 per year), a birth rate of two children per family would increase our population to 271 million by the end of the century and to 350 million in 100 years (with the population still growing). A birth rate of three children per family would result in a population size of 322 million by 2000 and more than 900 million by 2070.

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A stationary population could be achieved in the 20th century, should birth rates fall considerably below replacement levels, an achievement that appears unrealistic. Birth rates per family first would have to be below replacement levels through the next decades to compensate for more people entering child-bearing age than reaching old age and dying. That would create a smaller population of young people, who 20 to 30 years later would need to have more than two children per family to replace deaths at that time. Consequently, rapid adjustments to achieve zero population in this century could be accompanied by the undesirable effects of alternating high- and low-birth rates. A more gradual adjustment over a longer period of time appears more realistic and, by reducing these fluctuations in birth rates, also more advantageous.

In a population of stationary size, there can be considerable geographical redistribution of people from internal migration and differential rates of natural increase among regions. That redistribution also could be affected by the assumptions under which zero population growth is achieved. Family and consequently regional birth rates, for example, could be roughly equalized by encouraging each family to have no more than two children—a position similar to that taken by Zero Population Growth, Inc. Alternatively, a stationary total population also could be achieved through a mixture of high- and low-fertility families with different rates of growth among regions. In the first example, birth rates would be reduced proportionally more in areas of high birth rates (such as rural areas) than they would be in the second. I will point out later when those different assumptions could affect economic activity.

Economic growth under a stationary population

Under a stationary population, the distribution of economic activity in our country would depend to some extent on the general nature of economic growth that could be achieved under such conditions. That growth would be influenced by the nature of aggregate demand and business investments, which greatly influence the mix and total volume of products that can be produced. There is little evidence to support the notion that economic growth will cease once a stationary population is reached, although that growth understandably would be less than under conditions of a rapidly growing population (until that population would deplete available resources). In the aggregate, business activity

should expand from both increases in aggregate demand and continued investments in business ventures oriented toward economic growth [11]. Some businesses which depend heavily on young people and large numbers of people likely would suffer economic hardships, such as those dealing with baby supplies, housing, agricultural commodities, and the like.

Looking at aggregate demand first, anticipated increases in productivity during the next few decades should be large enough that family incomes and consumption should increase substantially, regardless of growth rates within the range of two or three children per family. Within that growth range, the Commission on Population Growth and the American Future [1] projects a minimum increase in real family income of \$9,000 and a doubling of consumption, particularly services. Serow's projections [10] indicate family income will increase to \$21,600 for Series D (2.45 children per family and 400,000 immigrants per year) and \$23,900 for Series X (2.11 children per family with no immigration).

Family incomes and consequently per capita consumption should also be higher in a population approaching zero growth than in one experiencing rapid growth. Per capita incomes could be as much as 15 percent higher [1] because of changes in the age structure leading to a greater percentage of working age persons and fewer nonworking dependents. Participation by women also would be increased, because a lower birth rate would mean fewer children to care for and, hence, greater opportunities for female employment. As an end result, per capita demand would increase faster under a stationary population than under a growing one. Total demand should increase considerably as well but at a slower rate than under more rapid population growth. The greatest growth in demand under a stable population would occur among commodities with high income elasticity, such as recreational activities, personal services, and airline travel.

Under a stationary population economic growth should be further expanded by opportunities to redirect investments into growth-promoting activities from human development activities which would have been required under a growing population to support more people. With lower birth rates and a stationary population, lower expenditures would be required for education, welfare, housing, and social services and infrastructure. For example, by the year 2000, a birth rate of two children per family would require \$124

billion less expenditure per year for education than would a birth rate of three children per family (\$276 billion and 9.7 percent of GNP compared with \$400 billion and 15 percent of GNP) [1]. That \$124 billion could be used to stimulate growth investments. Further savings could be realized from lower expenditures needed under zero population growth to correct pollution and social ills caused by population pressures. Spengler [11] has indicated that investment capital should be available at reasonably low interest rates, because higher per capita incomes under zero population growth should stimulate higher per capita (and consequently increased total) savings. Investment possibly could decline somewhat if investors become pessimistic in anticipating a stationary population, but our economy and government should be able to provide the stimulus for greater investment toward economic growth.

Population and the location of economic activity

Do industry and jobs preclude population location and growth, or do they follow them? There is considerable evidence that both forces are important. The growth in California's population in response to increased defense employment strongly supports the position accepted in past decades that employment may lead to regional population growth. During the last decade, decentralization of industry into lower wage regions of the South and Southwest and into such areas of preferred environments as Colorado supports the notion that industry also may migrate to find people (or to locations employees find desirable to live in).

Many factors can influence the future location of economic activity. The most important, of course, is the present location, since most established businesses are unlikely to move in the next few decades. Some new locations may be sought by new firms and by some established firms seeking expansions and relocations. Many research studies have shown that for those firms (particularly among large companies), labor, markets, raw materials, and transportation are major determinants in locating [7, 15]. Business facilities, financial assistance, and other community programs also may be important among smaller firms and those just getting started.¹ The recent

environmental awareness in our country also has increased the importance of desirable working and living conditions in selecting plant sites.

Some businesses may be restricted geographically by technical requirements, but new technical production processes should not greatly restrict the future distribution of economic activity because physical assembly and production techniques should be adaptable among most regions. Much technological development occurs with further expansion of previous technological processes in the same area [3], but use of such processes need not be restricted to areas where they originated. Improved transportation and communication systems have allowed geographic dispersment of businesses in the last few decades and that trend should continue. Technology for producing airplanes or cars, for example, is adaptable in the Midwest and South as well as in the West and North. Some restrictions or incentives to business location, however, may occur from the availability and cost of labor, natural resources, and energy. Those factors, already crucial in some location decisions, likely will increase in importance as population increases, even if that growth occurs in the process of arriving at a stationary population.

Influence of population on the location of economic activity is felt through interaction of both demand and supply factors. On the demand side of economic activity, the total population serves as the ultimate consumer of goods and services. The total size and income of the population are important determinants of the total volume of products that can be sold. Age structure and income per family also greatly influence the mix of goods and services desired. Changes in the composition and size of the total population influence businesses to redirect investments into new products with growing (rather than declining) demand and to select location sites with access to large and growing markets. On the supply side, businesses depend on the total population for their source of labor and, to a lesser extent, management. Business-location decisions are influenced by the need for a labor force large enough to achieve economies of scale and productive enough both to achieve efficiency and to adapt to new technology.

¹ Research in progress at Kansas State University shows that 68 plant managers of smaller firms locating in southeastern Kansas from 1960 to 1970 ranked the com-

munity-controlled factors of the availability of business facilities (such as buildings, utilities, and improved land), financial assistance, and community attitude, along with labor and transportation, as the five most important location factors.

Because of the interaction of supply and demand, economic activity in a country having a stationary population should expand most in areas where people are willing to live, where workers are available at competitive wages, and where resources to produce present and new products (particularly with a growing demand) can be purchased at competitive prices. In the future, greater competition between consumers and industrial producers for such commodities as clean water, air, and open space (at present often used at no expense to industries) may also alter the cost structure to industries and thereby influence their choices of new locations and work forces.

Relationships among population and location of business activity also may be influenced by such exogenous forces as changes in technology and tastes, international trade, and government policies to distribute economic activity. Current technology in many industries, for example, depends on large-scale production for efficient operation. Developing technological production processes that emphasize smaller-scale operations and mini-technologies undoubtedly would do much to increase the distribution of economic activity in the smaller population centers. Distribution may be influenced by new production processes that use different rates of natural resources, especially of water and minerals. Inexpensive technologies for recycling water could alleviate water shortages in the Southwest and other parts of our country.

In the area of new tastes and preferences, perhaps the greatest impact will be a greatly reduced tolerance by our general population for production technologies that pollute the environment. Stringent controls on pollution, together with large-scale efforts to correct conditions causing social distress (such as crowding), could easily make living and working in our larger cities much more costly than living in smaller urban areas and rural settlements. That could promote migration from the larger cities to areas with lower costs of living.

International trade in products that we produce or purchase as inputs also could alter the distribution of economic activity (from that occurring in a closed economy). Such changes would be particularly important for such products as agricultural commodities, which could be exported to foreign countries, to offset a stable or declining demand in the United States. Reserves of petroleum and other materials in foreign countries could play a significant role in determining

the types of business processes we may be able to utilize in the near future. Future use of many key minerals, however, is expected to rise much more rapidly in foreign countries than in the United States [1].

Finally, the pattern of economic activity developed through interactions in the private market may be accelerated or changed through government efforts to stimulate economic activity and influence its location—a good example being the heavy commitments to defense expenditures in California and Texas. Business locations also may be influenced indirectly through public efforts to develop communication and transportation networks, housing programs, agricultural payments and controls, and minimum wage laws.

Distribution of Economic Activity within the U. S.

For many decades, population and economic activity in the United States have been concentrating in metropolitan areas. That trend likely will be continued, even under zero or very low population growth. As pointed out in the preceding section, we should experience considerable economic growth even under a stationary population. Most of that growth should continue to occur in metropolitan areas, partly because of the large base of present business activity (to grow on) and partly because people tend to concentrate in those areas to live. Economic development, however, could be distributed unevenly among metropolitan areas of different population sizes, as well as between metropolitan and nonmetropolitan areas. That distribution is analyzed in the following subsections for: (1) our largest cities, (2) other metropolitan areas, and (3) agricultural and less densely populated areas. In this analysis it is important to note that the distribution of economic activity for regions and city sizes is made primarily with reference to our present distribution and amount of activity. I make some reference to what would occur under a growing population, although the many differences that could occur from various sizes of the population restrict such comparison.

The big cities

I would expect some growth in economic activity in our largest cities as our population grows in the process of reaching a stationary size. Once zero population growth is achieved, however, I would expect economic activity in those cities to level off or possibly to decline, for two reasons. First, as can be seen in Table 1, our 12 largest

Table 1. Population growth among metropolitan areas by categories of size, 1960-1970

Metropolitan Area Population, 1970	Number of Areas, 1970	Population in 1970 Boundaries (millions)	Population Increase, 1960-1970 (in 1970 boundaries)	
			Number (millions)	Percent (increase)
2,000,000 or more	12	52	6	12
1,000,000 to 2,000,000	21	28	6	27
500,000 to 1,000,000	32	22	3	18
250,000 to 500,000	60	20	3	16
Under 250,000	118	17	2	14

Source: The Commission on Population Growth and the American Future [1].

metropolitan areas (2 million or more people) as a group experienced the lowest rate of growth during the last decade of any of the categories of metropolitan cities. These 12 metropolitan areas are the old urban centers of the North, Baltimore and Washington in the Southeast, and Los Angeles and San Francisco in the West. Their growth rate indicates a lower aggregate preference for living and working in these areas than in smaller metropolitan cities, a position supported by Niles Hansen [4] and opinion polls [2, 16]. These largest areas, particularly the city centers, suffer from antiquated transportation systems, pollution, and social problems caused by high population density. The growth of these 12 areas, 12 percent for the decade, was slightly under the rate of the U. S. as a whole and only enough to maintain their natural increase. Without any net increase under a stationary population, little growth could be expected in these areas.

The highest rate of growth for the decade was among metropolitan areas of 1 to 2 million population. Those areas, many of which are located in the South and Southwest, should continue to grow proportionally more than the 12 largest areas. This growth, however, could intensify their urban problems to the level of those in the largest cities, and thus reduce their growth rate after several decades.

My second reason for expecting rates of economic growth to decline in our largest metropolitan areas is that our general population apparently is rapidly decreasing its tolerance for production processes that pollute the environment. If fully assessed, the social costs of pollution, together with the costs of correcting social ills from high population density, could so increase the costs of doing business and living in these areas that residents and new businesses would find it more economical to locate in less-populated areas. Large scale and rapid relocation of many present industries would be unlikely, however,

because of their large fixed investments in these cities and their need for large-scale operations. Consequently, economic activity would tend to stabilize in the large centers under zero population growth with little increase or outmigration of present businesses.

Our largest cities, however, could receive the greatest benefits from zero population growth. Already they are operating in a scale of services much too large to be efficient² and are faced with very large costs for modernizing their infrastructure and correcting undesirable social behavior. In the absence of zero population growth, additional people (particularly under high birth rates) would increase those costs even further and more rapidly than in smaller cities.

Other metropolitan cities

My next hypothesis is that the greatest expansion in economic activity should occur in the group of metropolitan cities from 50,000 to as large as 1 or 1½ million people. Those centers attract many migrants and have experienced growth rates in excess of the national average. Most operate services at a much lower cost per unit than do our largest metropolitan areas, and they face fewer problems of pollution and congestion. Many also are at a stage of growth that allows them greater control over expansion and consequently provides them with an opportunity to develop in a more orderly fashion than our largest centers.

Many of the rapidly growing metropolitan areas are located in the South, West, and Southwest—the geographical areas which could experi-

² Hirsch [6] estimates most economies of scale for services to occur in the population range of 50,000 to 100,000, while Morris [8] estimates that lowest per capita costs for services as a group (excluding travel) occur in cities from 50,000 to 1 million. When travel costs were also included in Morris' study, the lowest per capita costs were in smaller cities of 10,000 to 20,000 population.

ence the greatest future expansion in economic activity and population. As new industries tend to look for expanding labor and consumer markets, those areas should be preferred locations. Furthermore, the relatively low wages in the South and Southwest [12] should stimulate business expansion there. Zero population growth also should alleviate severe restrictions on growth because of water shortages, now present in the Southwest and possibly critical in the future under higher population growth.

Agricultural and nonmetropolitan areas

I further hypothesize that the greatest burden of adjustment to zero population growth would occur in nonmetropolitan areas, especially those heavily dependent on agriculture. Agricultural areas would be adversely affected because a stationary population would nearly stabilize the total demand for agricultural products, a demand influenced more by population numbers than that of most products. The demand for some commodities, such as beef, could be increased by rising per capita incomes. But agricultural products in general have relatively low income elasticities (particularly at the high incomes anticipated in the future under zero population growth), and therefore we could expect only small increases in domestic demand for them. Once a stationary demand has been reached under zero population growth, increases in production likely would lead to conditions that would even accelerate our present rate of displacement from agriculture. In the past decades, technological improvements in agriculture have been nearly double the average for nonagricultural industries.⁸ I see no reason for that rate of technological improvement to decline in the near future or to stop once zero population growth has been achieved, although the rate could decline once we reach a constant population size. Such increased production should decrease product prices which, together with expected increases in agricultural input prices, should greatly reduce opportunities for agricultural employment throughout the United States. International trade in agricultural products could alleviate somewhat the problems of a stationary demand, but opportunities for trade are difficult to predict because they are often based on political rather than economic decisions.

⁸ Output per man-hour in farming increased 300 percent from 1950 to 1970 (from an index of 37.7 to 113.1), while nonfarm output increased only 160 percent (65.0 to 103.8) [13].

The decline in U.S. agricultural employment should be offset somewhat by expanding employment opportunities in nonagricultural industries locating in nonmetropolitan areas. The outlook for nonagricultural industrialization, however, is much more optimistic for nonmetropolitan areas of high-population density than for those of low density. This optimism is based on the present decentralization of industries into nonmetropolitan areas having large available work forces [5]. Such decentralization should continue under zero population growth because many products (such as recreational vehicles, sporting equipment, musical instruments) that will increase in demand as per capita incomes increase can be produced efficiently in smaller communities. Industries producing many such products can be operated on a small scale, would use reasonably but not highly skilled or technical workers, and would require less capital per worker than do larger-scale industries. With lower overall expenditures required for education under a stationary population than under a growing one, a relatively greater amount of money also could be spent in lagging areas to improve human skills for nonagricultural employment. Opportunities for nonagricultural employment, consequently, should develop where the labor density is high enough to attract nonagricultural industries, such as in the South, in parts of the Corn Belt, and in the West.

Nonmetropolitan areas of low population density, on the other hand, such as those in the Great Plains, could suffer severely from large reductions in agricultural employment because most of the communities located in these areas are not large enough to provide minimum-size labor forces (5,000 to 10,000 people) for many nonagricultural industries. Furthermore, few commuting opportunities exist in some sparsely populated areas, particularly in the Great Plains, because these areas contain so few cities of even 50,000 population. As much as 90 percent of the short grass plains area is beyond commuting distance to metropolitan cities.

With a declining agricultural labor force, many small communities in sparsely populated areas will find it even more difficult to provide services, shopping facilities, and reasonable living conditions than at present. Many such communities now cannot provide adequate services, because the minimum scale is too large for their population base. As services become more specialized, with the number of people needed for efficient operation possibly increasing, it will become even more difficult to provide such services

in the future. The low population of these communities cannot be increased by high birth rates under zero population growth. Furthermore, few people likely will immigrate to low-population density areas, such as in the Great Plains, without special incentives because their population density is already too low to support efficiently the services needed to attract more people.

Currently, many nonmetropolitan areas of the Great Plains are already experiencing zero and even negative population growth. In the Great Plains States from 1960 to 1970, 64 counties experienced natural decrease (more deaths than births) [14]. Many additional counties experienced natural decrease in individual years during this decade, and many others almost did. The very low or zero population growth rate in those sparsely populated areas has not alleviated the problems of providing services, generating taxes, and creating new job opportunities. Furthermore, selective migration of young people from the areas has increased the overall average age to nearly 50 years in some counties, thus greatly reducing the number of people of child-bearing age. Should the few families of child-bearing age remaining in these areas voluntarily restrict family size to two children, their offspring would not be enough to maintain the population in those areas. However, this birth rate would allow some short-term growth throughout the U. S. where more young couples were living.

Government policies affecting the distribution of economic activity

Government policies, which in the past definitely have modified the impact of market forces on the distribution of people and economic activity, should continue to be important. Currently, the National Goals Research Staff [9] has examined three alternative policies for influencing the future distribution of population and economic activities throughout the United States. These policies are: (1) A "spread" policy to keep population in the countryside and small towns, for example, by encouraging factories to locate in the countryside and by supporting intensive farming operations; (2) expansion of intermediate-sized cities (50,000 to 750,000 population) as an alternative to additional concentration of population in the larger metropolitan areas; and (3) the creation of new communities.

The strategy of expanding intermediate-sized cities is preferred for national development by the National Goals Research Staff and is essentially the position supported by Niles Hansen and Brian Berry. The population-spread strategy

is rejected primarily on the basis of insufficient cities of 25,000 people or more in which to locate modern growth industries and services. Though difficulties in starting entirely new cities are recognized, some consideration of that concept is made in connection with expanding new communities from an existing community core of 25,000 to 50,000 population.

The preferred development strategy—to expand intermediate-sized cities—should accelerate the effect of zero population growth by directing even more growth investments from rural areas and big cities into the intermediate communities. That policy, while keeping the big cities from becoming bigger, definitely would not benefit sparsely populated areas which are hurt the most by zero population growth because, in general, they have no intermediate-sized cities within their boundaries or within commuting distance. Intermediate cities, by serving as destinations for migrants who leave the low-population density areas, can benefit these migrants. That migration, however, places most of the cost of adjustments on those who remain in the community experiencing the outmigration. Those remaining in the smaller communities suffer from declining service quality, shopping facilities, real estate values, and deteriorating institutions. The deterioration of these communities, consequently, may be an important cost of restricting investments to intermediate centers.

In evaluating a growth strategy concentrating public investments in intermediate cities, we must, therefore, consider the loss of existing public and private capital through deterioration in nonsupported cities. Here, the crucial question is: Could investment in existing communities (to stop further deterioration) save more resources and value than would be created in the form of new community resources by investment in intermediate cities? This question, not yet examined adequately, may justify an economic reappraisal of the policy of investing exclusively in the intermediate-sized cities.

Summary and Conclusions

Adjusting to zero population growth in our country could not be achieved realistically without some additional population growth during the next 50 to 70 years. Aggregate economic activity should expand as we adjust to a stationary population and continue to grow once that condition is reached because of increased aggregate demand from higher per capita incomes and because of investments redirected from human development to growth activities. In the absence of

significant increases in international trade to expand the demand for agricultural products and with strong population support for the full assessment of social costs of pollution and correction of the social ills in major cities, zero population growth likely would cause a relative movement of economic activity to metropolitan cities of 50,000 to 1 or 1½ million people from our rural areas and largest cities. Geographically, that would represent a relative movement from the North (large cities) and from the Central Plains and Corn Belt (rural areas with low population densities) to growing areas in the South, Southwest, and West. This movement could be compounded by a population policy to concentrate government investments in the intermediate-sized cities.

The benefits of zero population growth, consequently, would go primarily to metropolitan areas. The larger cities, where economic development and population growth would be stabilized, could benefit greatly from reduced costs of services and correctional capital for the pollution, traffic congestion, and overcrowding that would occur under higher population growth rates. Smaller metropolitan areas could benefit from immigration of many well-educated individuals from rural areas and overcrowded cities and from increased business activity attracted by this expanded labor supply. The greatest burden of adjusting to zero population growth would be borne by agricultural areas, which would face reduced farming opportunities because of a nearly

stabilized demand for agricultural products. Rural areas of low population density would be hardest hit, because they do not contain enough people to attract nonagricultural industries. Rural areas with high population density likely should be able to provide nonagricultural employment in business producing products that will increase in demand as per capita incomes rise, such as those associated with recreation and leisure time activities.

Zero population growth also should decrease further the number of people in sparsely populated areas below the minimum needed to provide many services and to attract nonagricultural industries. Consequently, very small towns might benefit by cooperating with other small towns to create a larger, integrated, multicounty community. The larger multicounty population thus created could support additional consolidated services and provide a larger labor market (through commuting) for new industry. Government assistance to establish greater multicounty cooperation could be incorporated through a "population-spread" policy which, undertaken in cooperation with investments in intermediate-sized cities, could provide a greater balance of economic development between rural and urban areas. Without supplementary government assistance for rural areas, however, it appears that zero population growth would be an urban policy with urban beneficiaries and not one designed to provide many benefits for rural areas.

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FIRST AWARD PAPER IN THE UNDERGRADUATE STUDENT ESSAY CONTEST

Analysis of Potential Hedging Criteria for Live Hogs Using Seasonal Indices

JOHN E. WOOD

MODERN swine producers are faced with high input prices and an unstable market price for their product. Given economies of scale, swine operations are growing larger; producers no longer have the opportunity to stop production when price is unfavorable and restart production when prices begin to rise. Large slaughter hog operations, indeed, need a means to stabilize the returns from their production in order to facilitate long-range planning.

A study from Oklahoma State University by Holland, Purcell, and Hague [2] analyzing cattle feeding operations in the Oklahoma panhandle found that mean net returns could be increased and variance of returns could be decreased by selective hedging. Hedging based on the seasonal index of beef cattle provided a simple criterion as to when to place a hedge.

Contracts for live slaughter hogs have been available since 1966 and hog prices show a very pronounced seasonal pattern. Thus, the potential of relating a seasonal index to hedging decisions and thereby stabilizing the net returns from hog operations is a topic that warrants study.

To test the possibility of using the futures market in stabilizing net returns to slaughter hog producers, a study similar to the OSU slaughter cattle study is presented. The desirability of any decision criterion or strategy is measured by the average size and variance of net returns as opposed to a simple cash operation.¹ A per head variable cost equation derived from average Oklahoma swine operations is used in the model as follows:

$$TVE = 4.68 * PGS + .45 * FEDP + \$7.58,²$$

¹ This analysis considers only the feeding operation and disregards any fixed costs.

² The accuracy of the cost equation is rather immaterial in regard to this analysis. Cost acts only as a base point from which to compare strategies. The relative relationship between strategies will remain despite absolute level of returns to the enterprise.

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where

TVE = total variable cost per head to produce a 215-pound slaughter hog;

PGS = price per hundredweight of grain sorghum in Oklahoma City; and

FEDP = feeder pig price per hundredweight (computed as 160 percent of market price at Oklahoma City for slaughter hogs).

Thus, 468 pounds of grain sorghum must be fed to a 45-pound feeder pig along with \$7.58 worth of other inputs such as grinding, mixing, and supplement. The basis for calculating feeder pig price as 160 percent of slaughter hog price lies in the relationship between the two price series and is discussed by Maynard [3]. Also, most Oklahoma swine operations presently engage in both the farrowing and feeding functions, therefore limiting the existence of organized feeder pig pricing points. Note this analysis disregards commission costs and interest on security money. These costs, however, can be handled by the individual manager and will vary between operations.

The Model

The present study includes the 58-month period from March 1966 through December 1970. Values for cash price are the monthly average on the Oklahoma City market during the study period. Futures quotes are obtained from the respective yearbooks of Chicago Mercantile Exchange [1]. Contracts are not traded for all months under study. In such instances, the futures quote for the day needed is taken from the next month in which contracts were available.³ To simplify the model, the only time a hedge can be placed is on Thursday of the first week of each month. Once sold, the contract cannot be

³ Thus, if no February contract was traded and the quote for February 15 was needed, the price at which March contracts were selling on February 15 would be used as the quote for February 15.

bought back until the trading day nearest the fifteenth of the month three and one-half months later.⁴ Thus, hedges are either made for the entire feeding period or they are not placed at all. The three and one-half month period is considered a sufficient time in which to feed a 45-pound feeder pig to a 215-pound slaughter hog [4].

The model seeks to base decisions on some aspect of the seasonal index for slaughter hogs. Most producers have reasonable access to sea-

⁴ If a lot of feeder pigs were started on feed in January, the hedge would be placed on the first Thursday of January or, if there was no trading on Thursday, on the first Wednesday. The hedge position could not be changed until the trading day nearest April 15.

sonal indices, and seasonal indices are fairly easy for the swine manager to use. This study used a seasonal index based on the five years ending in 1971 using the prices on the Oklahoma City market. Figure 1 shows this seasonal index for slaughter hogs.

Decision Criteria

Application of the model previously presented to calculate values for average net returns and variance provides the basis of comparison for all selective hedging strategies. Table 1 shows the values and statistical tests of significance for all situations considered. Thus, the average net returns for a straight cash enterprise is \$14.26 per

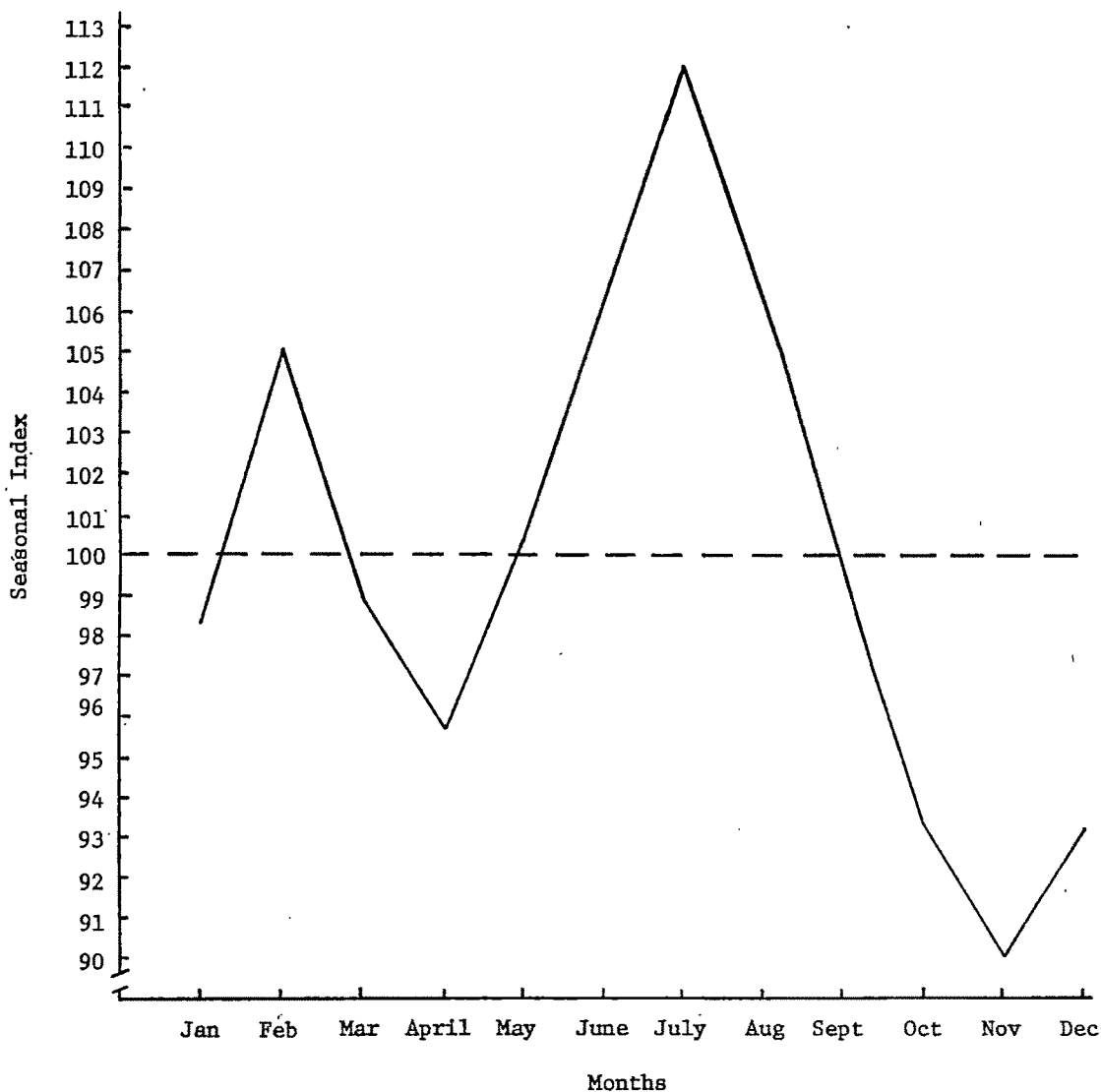


Figure 1. Seasonal price index for slaughter hogs

Table 1. Summary of mean and variance of net returns per head under alternative hedging strategies

	Total Net Revenue Above Cash	Average Net Revenue	Variance of Net Revenue	Z Statistic Relative to Mean of Cash Market	F Statistic Relative to Variance of Cash Market
Cash Market	\$ 0.0	\$14.26	\$ 44.30	None	None
Full Hedge	105.99	16.09	109.56	1.5730	2.4733*
Strategy 1	18.04	14.57	63.33	.3201	1.4296
Strategy 2	33.02	14.93	80.62	.6427	1.8198*
Strategy 3	138.83	16.65	90.07	2.2047*	2.0333*
Strategy 4	141.28	16.69	96.55	2.1913*	2.1797*
Strategy 5	141.81	16.70	96.42	2.2007*	2.1766*

* Indicates statistical significance at 5 percent level using two-tailed test.

head with a variance of \$44.30 per head. If a swine producer chooses to hedge each pig, he could increase average net returns to \$16.09 but at the same time would cause the variance of net returns to increase to \$109.56 per head. Though there appears to be a marked increase in average net returns by a full hedge,⁵ statistically the change is not significant at the 5 percent level, while there is a statistically significant increase in the variance at the 5 percent level. Total net returns above cash⁶ to the completely hedged operation are \$105.99 more for the entire 58-month period than the total returns to the strictly cash operation.

Strategy 1

Now that a basis for relative comparisons of selective hedging strategies has been established, there are several criteria that seem to warrant consideration. In the previously mentioned OSU study, Holland, Purcell, and Hague found that since the typical seasonal price pattern for cattle was declining in the fall months, a cattle feeder improved his position by simply hedging all cattle to be sold in these later months. Strategy 1 is an attempt to see if such a criterion was useful for swine feeders. For the most part, however, Strategy 1 proved unsatisfactory. Even though there occurred an increase in average net returns as compared to cash of \$.31 per head, variance also increased from \$44.30 to \$63.33 per head. Neither of these changes, however, is statistically significant at the 5 percent level.

⁵ Full hedge here implies a hedge placed every month.

⁶ Total net returns above cash are the total returns above cash an operator would receive if he marketed one hog per month during the study period.

Strategy 2

Strategy 2 is a decision criterion based entirely on comparing seasonal indices without regard to any futures quote or cash price. Using Strategy 2, a decision to hedge is made if the seasonal price index in the month of sale is lower than the price index associated with the beginning of the feeding period. Thus, the producer, based on seasonally anticipated prices, would place a hedge if seasonally anticipated price was less than current cash price. The results of this strategy, however, do not indicate that reliance solely upon the seasonal index to predict the direction of market movements is a good decision criterion. Strategy 2 significantly increased variance of net returns at the 5 percent level while no statistically significant increase was realized in mean net returns. Table 1 shows the empirical results of Strategy 2.

Strategy 3

Strategy 3 uses not only a seasonal index but also incorporates data on both cash and futures markets. In Strategy 3 an adjustment coefficient is calculated by dividing the seasonal index for the month in which the feeding period ends by the seasonal index associated with the month in which the feeding period begins. The adjustment coefficient is multiplied by the cash price at the beginning of the feeding period giving an estimated seasonally adjusted cash price (ESACP). Once the ESACP is calculated, a decision is made to hedge if the futures quote for the month ending the feeding period is greater than the ESACP. Strategy 3 proves to affect average net returns quite favorably, but only at the expense of increasing the variance of these net returns. Average net returns using Strategy 3 increased by \$2.39

as compared to a full cash operation. The variance of net returns increased by \$45.77 per pig over the cash operation. Both of these increases are statistically significant.

Strategy 4

Strategy 4 is similar to Strategy 3 in that it also uses the estimated seasonally adjusted cash price as part of its hedging criterion. In addition to hedging based on the ESACP and futures quote, Strategy 4 also hedges when the feeding period ends in January regardless of what the Strategy 3 criterion dictates. By doing so, Strategy 4 raised average net returns per head by \$2.43 from \$14.26 to \$16.69. Variance of net returns, however, increased to \$96.55 as compared to a \$44.30 variance in an all cash situation. Thus, variance increases by \$52.25. Again, both changes are statistically significant.

Strategy 5

As in Strategy 3, Strategy 5 uses the estimated seasonally adjusted cash price (ESACP) while also hedging regardless of the value of ESACP if the feeding period ends in either January or February. Thus, Strategy 5 attempts to capitalize on the somewhat secondary peak in the seasonal index in February as seen in Figure 1. Strategy 5 results in average net returns increasing by \$2.44 over a cash operation while variance increases by \$52.12. When compared to a cash operation,

both of these increases are statistically significant at a 5 percent level.

Conclusions

The five selective hedging decision criteria discussed provide, at best, a superficial analysis of the potential advantages of hedging live hogs. In all strategies considered, however, with each increase in average net returns per head in a feeding operation came a significant increase in the variability of returns. Thus, with strategies 3, 4, and 5 providing significant increases in mean net returns, it remains a decision for the individual manager as to how much variation he is willing to accept in return for higher profits.

Points of Further Inquiry

The development of this model and analysis of its results open an area of inquiry with considerable potential. If the use of a simple seasonal index to influence hedging decisions can cause such marked changes in profits, the use of a more sophisticated short-run price predictor might prove to be even more useful. More study in order to explain why hedging when the feeding period ends in January and February increases net returns is necessary to get a more complete understanding of the market situation. With more empirical study, the futures market may prove to be a tool enabling swine feeders to meet the challenge of a variable modern agriculture.

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ABSTRACTS OF AWARD-WINNING THESES

Doctoral Theses

Raul E. Yver, *The Investment Behavior and the Supply Response of the Cattle Industry in Argentina*, The University of Chicago, 1971.

This study shows that the cattle industry of Argentina is highly responsive to changes in beef prices. The measured response is in the direction predicted by the theory of investment behavior stated in the thesis. This theory views cattle as a composite capital good to be held by the cattle firm as long as the capital price of animals exceeds their consumption price. Under conditions of certainty the capital price and the consumption price are equated at that point in time (age of the animal) at which the present net discounted value of the animal at birth (or for its remaining lifetime) is maximized.

The relative capital prices of animals of different ages (different discounting horizons) change when market conditions change. Since the relative consumption prices of the different categories of animals cannot change very much because of the high cross-elasticity of demand for beef from different animals, the cattle firm responds to the changed structure of relative capital prices by altering the (quantity) composition of its stock of animals in an attempt to equalize the rates of return to investment in its mixed animal portfolio. In particular, it is hypothesized that the maximizing response of the firms with a fixed amount of grazing land when beef market prices increased is to disinvest in some animals (steers) and invest in other animals with a longer economic horizon. The empirical results show that this is the way the cattle firms in Argentina actually behave: when beef prices increase, the initial response is for steer sales to increase (reduce stocks), while sales of other animals decrease (increase stocks).

My concept of long run is one where enough time has elapsed so that herds can be built up to the desired level following a price increase and only then, under the new steady state conditions, will the flow of sales stabilize at the new higher equilibrium level. Results presented in the thesis indicate that the response of aggregate sales will be negative for two years after the price increase and then become increasingly positive from the third year on. The long-run elasticities of sales are relatively high (above unity), so that price policy can exert a positive impact on beef production if properly used and if enough time—say, five years—is allowed for the major portion of the required adjustments to take place.

The size of the positive long-run supply elasticities of cattle sales relative to the negative elasticities with respect to crop prices (the former being three or four times as large in absolute value), in conjunction with the positive supply elasticities of crops

found in other studies, imply price policies that raise both beef and crop prices can have a positive impact on aggregate agricultural production in Argentina. If these elasticities were roughly of the same magnitude (in absolute value), then a price policy that raised both beef and crop prices by, say, 10 percent would leave cattle output constant. The movement along the long-run supply curve of cattle would be offset by a shift back of the cattle supply curve in response to the higher crop prices. This does not seem to be the case, however, and the fear that the observed positive response of crop production to crop prices represents only a shift of resources away from cattle production does not seem to be warranted.

The nature of the response of the cattle industry to increased beef prices, which in the short run tends to push beef prices even higher, requires a period of three to four years for the effects of a policy to show its fruits in the form of increased sales to slaughter and downward pressure on beef prices. If the policy is adhered to, which is recognizably difficult, Argentina may still be able to make the cattle industry a major source of gains in agricultural production and exports. Knowing that the payoff will be forthcoming, as shown in this study, might make the transition period easier to justify.

Charles K. Mann, *Taste, Technology and the Government: The Case of Tobacco*, Harvard University, 1971.

Taking tobacco as a case study, this analysis focuses on interactions between government, technology, private industry, and consumer taste. Based upon a quantitative analysis of these interactions, changes are predicted in the demand for flue-cured and burley tobaccos, in the government programs controlling their production, and in the technology with which they are produced. Extensive labor displacement is foreseen as the cumulative effect of these changes.

The analysis includes an examination of the effects of change on income distribution, concluding that past technical change has tended to concentrate flue-cured program benefits and disburse burley program benefits. An anomalous provision protecting small burley growers against acreage reduction has further lessened the concentration of benefits. Despite a generally unequal distribution of benefits within the two programs, tobacco growers as a class have low incomes relative to the rest of society.

A detailed study of eight counties suggests how the impact of future change may differ by geographic region. Locally severe dislocation is projected, as changes in government programs threaten to concentrate demand reduction in marginal production areas. Several proposals are advanced to cushion the dislocation, the most novel of which are graduating allotment reduction by income status and design-

ing conversion programs to concentrate tobacco acreage reductions in areas with the most promising non-tobacco alternatives.

David M. Bell, *The Impact of Air Pollution Abatement Activities of Coal-Burning Electric Power Generating Plants on the Fertilizer Industry*, Michigan State University, 1971.

Society is becoming increasingly sensitive to damages caused by air pollution. The sulfur oxides, which are exceedingly damaging to most materials and to plant and animal life, are receiving much of this attention. Although legislation designed to solicit control of sulfur oxide emissions has already been enacted, more persuasive controls primarily taking the form of direct regulation can be expected to originate from the Environmental Protection Agency in the near future.

Numerous processes designed to recover sulfur oxides from the flue gas of electric power generating plants, which account for more than one-half of all sulfur oxide emissions, are in varying stages of development. Many of those processes produce by-product sulfuric acid, while a few produce ammonium sulfate and a few produce throwaway products. Both sulfuric acid and ammonium sulfate have value to the fertilizer industry.

Consequently, a comprehensive linear programming model based on the prominent characteristics of the fertilizer industry as it relates to the Michigan market was developed with an elaborate set of controls to examine the impact of production of by-product ammonium sulfate and sulfuric acid on the optimal organization of the fertilizer industry. The model was designed so that other problems of interest to participants in the fertilizer industry and to those who consume its products could be studied as well.

The long-run optimal organization of the fertilizer industry is based on three high-analysis products: anhydrous ammonia, monoammonium phosphate, and granular potassium chloride. Most of the latter two products are used in dry blends, while anhydrous ammonia is used for direct application. By producing and distributing these products optimally, the cost of supplying the amount of N, P_2O_5 , and K_2O consumed in Michigan in 1970 can be reduced by 32.4 percent from the amount farmers actually paid.

Three uses for by-product ammonium sulfate were examined: direct application, granulation, and bulk blending. Although the use of ammonium sulfate for direct application was superior to the two alternative uses, it competed with N provided in the optimal product mix at very low prices only (\leq \$2.00 per ton). However, if some value were imputed for its sulfur content and if it competed with products currently being used, it would sell at significantly higher prices.

At the currently low price for sulfuric acid at the Gulf Coast area (approximately \$12.50 per ton),

production of phosphoric acid via the elemental phosphorus-white phosphoric acid route cannot compete economically with the sulfuric acid-green phosphoric acid route, even in the short run. Although the consumption of sulfur in the United States is increasing annually, primarily in fertilizer production and manufacturing, the potential supply of sulfur is so great that sulfur prices can be expected to be relatively low for some time to come.

By-product sulfuric acid produced in Michigan cannot be used efficiently in the fertilizer industry. But, the high concentration of manufacturing in the North combines with its remoteness from sulfur sources in the Gulf Coast area to provide a good market price for sulfuric acid for those power plants that may choose to produce it.

Honorable mention

Mario Kaminsky, *The Structure of Production of Multiple-Output Dairy Farms in the "Centro Santaferino" Region of Argentina; A Multivariate Analysis*, University of Wisconsin, 1971.

The study objectives were: To provide an assessment and interpretation of the development of the dairy sector of Argentina and its main geographic area devoted to dairy for manufacturing; to evaluate current dairy policy issues as represented by proposals for a National Dairy Law; to ascertain the technical and economic production structure of dairy farming in the "Centro Santaferino" region and test related hypotheses.

These objectives were achieved by (1) the assembly of formerly scattered national and regional information related to the sector and its subsequent analysis and evaluation; (2) the economic evaluation of the effects of a National Dairy Law; (3) the description of dairy farms in the region and the characterization of their production structure using micro-analytic data generated by a special survey taken during 1970. These data were used for a tabular, graphic, and statistical analysis of the dairy farms' main traits, their levels of productivity, the factors affecting them, and the configuration of groups of farms with differences regarding these traits and especially those relating to managerial abilities. Single-output and multi-output production surfaces of several groups of farms were estimated, also using survey data.

A critical review of the literature in the areas of theory and econometrics of production and some additional developments provided the methodology for analysis of the production structure. It included the explicit consideration of multi-output production in the estimation of production surfaces using canonical correlation analysis; derivation of a theoretically appropriate functional form for that purpose; a method of accounting for management bias using discriminant analysis; a procedure to evaluate service flows from capital goods; and a procedure to approx-

imate the significance of individual coefficients estimated by canonical correlation analysis. Multiple regression analysis was utilized to estimate single-output production surfaces, and analysis of variance was used for evaluating several secondary factors thought to influence productivity differentials. The use of binary or "dummy" variables allowed for further flexibility in the estimation of single- and multi-output production surfaces.

The overall approach proved fruitful and, among others, provided for the following findings: There are underdeveloped productive potentialities in the sector and region which, to be exploited, require a purposive action to be facilitated by a National Dairy Policy. Low managerial levels constitute a barrier to the improvement of dairy farming and therefore demand preferential attention. The data indicate that extension efforts to disseminate new technologies should be capable of demonstrating to farmers that they more than compensate for the extra costs in terms of money and loss of leisure. The commonly held hypothesis that owner-operated farms are in some sense better than farms operated with share milkers is not warranted by the data. The study also proves that a greater specialization in milk production is not a desirable goal for all types of dairy farms. This is shown by the derived optimum paths of adjustment for these groups in terms of input and output mixes. Special extension and credit policy efforts are also needed to reduce the high seasonality of production and lead to a more highly commercialized type of dairying in the region. Although dairy farmers in the area are generally aware of price relationships, they fail to adjust optimally to them. This is partially due to rather severe fixities in resource availability reflected, for example, in intra-group differences in the marginal productivities of labor and higher or lower orientation towards beef production. The main difference between farms operated with and without share milkers was found to be the larger scale of operations of the former type.

Honorable mention

Gerald Arthur Doeksen, *A Social Accounting System and Simulation Model Projecting Economic Variables and Analyzing the Structure of the Oklahoma Economy*, Oklahoma State University, 1971.

Main objectives of the study were to develop a social accounting system and a simulation model for the economy of Oklahoma. Secondary data were used to formulate the social accounting system for Oklahoma. Economic activity within the state was classified into 12 endogenous sectors and five exogenous sectors.

The social accounting system was developed in three main accounts: the interindustry account, the capital account, and the human resource account. The *interindustry account* consists of three basic

parts: a transaction or flow table, a direct coefficient table, and a direct and indirect coefficient table. The *capital account* includes eight basic parts: a capital coefficient matrix, capital-output ratios, capital stock matrix, capital unit matrix, capacity estimate, inventory coefficients, investment matrix, and depreciation coefficients. The *human resource account* contains income and employment data.

The simulation model was formulated around the basic Leontief input-output system. The complete multiple sector recursive model consists of 51 major equations, many of which were disaggregated into subequations, one subequation for each endogenous sector in the Oklahoma economy. Thus, the entire system includes over 300 equations. The model was formulated in Fortran and run on the computer at relatively low cost, enabling the researcher to experiment with the model by changing variables and measuring their impact. The model was used to project economic variables such as income, employment, gross product, and taxes from 1964 to 1980 and to measure the impact of a \$1 million investment in a sector.

Total employment was projected to increase by 54 percent from 1963 to 1980, wage and salary employment by 71 percent, and proprietor employment by 10 percent. The slow growth in proprietor employment results from a decline in the projections of farm proprietors. In fact, the number of farm proprietors is projected to decrease by 21 percent from 1963 to 1980. Wage and salary employment is projected to increase in all sectors, except in the agricultural, mining, and construction sectors, from 1963 to 1980. These sectors are victims of rapidly increasing technology, thus reducing the need for additional workers. The sectors projected to have the greatest increase in wage and salary employment are the machinery and other manufacturing sectors. In the machinery sector, wage and salary employment is projected to increase 116 percent from 1963 to 1980, while in the other manufacturing sector it is projected to increase 113 percent. Income projections in constant 1963 dollars indicate that personal income is expected to increase 154 percent from 1963 to 1980, wage and salary payments 142 percent, and proprietor income 82 percent. Per capita income is projected to increase 116 percent from 1963 to 1980.

The impact analysis consisted of measuring the effect on income and employment of a million dollar investment in a sector. The effects were measured in the short, intermediate, and long runs, and multipliers for income and employment were derived. If the goal is to maximize the total number of man-years employed per man-year directly employed in production, the sector with the largest employment multiplier should be stressed. In the short and intermediate runs, petroleum and coal products, agricultural processing, and mining have the largest employment multipliers. In the long run, the agricultural processing, petroleum and coal products, and machinery sec-

tors have the largest employment multipliers. If the goal is to maximize total income per unit of income directly generated in a sector, the largest income multiplier should be stressed. The multiplier indicates the change in income generated throughout the Oklahoma economy by a one-unit change in production income for that sector. Petroleum and coal products, agricultural processing, and livestock and livestock products sectors have the largest short- and intermediate-run income multipliers. In the long run, petroleum and coal products, agricultural processing, and other manufacturing sectors have the largest income multipliers.

If the goal is to maximize employment with a limited investment, the sectors with the lowest direct cost per job created should be emphasized. In the short run the wholesale and retail trade services and construction sectors have the lowest cost per job directly created, while the agricultural processing, construction, and wholesale and retail trade sectors have the lowest cost per job directly and indirectly created. In the long run, the agricultural processing, construction, and service-type sectors have the lowest cost per job created directly, indirectly, and induced. If the goal is to maximize income created with a limited investment, the sectors with the lowest cost per million dollars generated should be employed. In the short run, the service, wholesale and retail trade, and construction sectors have the lowest cost per million dollars directly generated in a sector, whereas the construction, agricultural processing, and service sectors have the lowest cost per million dollars directly and indirectly generated. In the long run, the construction, agricultural processing, and service sectors have the lowest cost per million dollars generated directly, indirectly, and induced.

MASTER'S THESES

Geoffrey H. Jackson, *An Economic Analysis of the Quota on United States Beef Imports*, Cornell University, 1971.

Purpose of this study was to evaluate the impact of elimination of the quota on imports of fresh, frozen, and chilled beef (P.L. 88-492) in 1975 on U.S. consumers and producers as well as on those nations supplying beef to the U. S.

Projections for 1975 were made for the supply of frozen beef from those countries or regions which, as a result of health regulations, have been the major suppliers to the U. S. in recent years, namely Australia (50 percent), New Zealand (20 percent), Central America (12 percent), Ireland (7 percent), and Canada (3 percent). Increase in the supply of beef from these countries in the absence of quotas or other restraints (over what imports would have been under existing legislation) was estimated to be 670 million pounds in 1975. This would represent an increase of only about 2.5 percent in the total supply of beef to U. S. consumers.

In order to estimate the impact of increased imports on retail prices, two price-forecasting models were constructed using quarterly data for the period 1959-1969. The major distinction between the two models was in differentiating between high- and low-grade beef in the second model. In the first model imports contribute to the total supply of beef, while in the second model imports contribute only to the supply of low-grade beef. Based on these models and the preceding estimates of increased supplies, forecasts were made of retail prices. The results indicated that price reductions in the absence of quotas would probably be relatively small, ranging between 1.1 and 2.6 percent for different categories of meat. Reduction in the retail price of low-grade beef (based on Model II) was found to be twice that of high-grade (fed) beef. Since a higher proportion of low-grade than high-grade beef is probably consumed by low-income families, this suggests the elimination of the quota would have the effect of benefiting low-income families slightly more than high-income families.

The effect of the quota would be to reduce producer prices as well as retail prices. Since the margins of feed-lot operators would not likely be affected by the change in supplies, the major impact of imposing imports would be felt by ranchers and those selling cull cows. Ultimately, somewhat lower prices would probably result in slightly smaller domestic production of beef.

The impact of lower prices on returns to resources employed in beef production also was estimated. A model was developed which expressed the change in returns to resources used in production as a function of own, cross, and product price elasticities of demand for the input, the input supply elasticity, and the change in the tariff equivalent of the quota. This model was then used to estimate the effect which eliminating the quota would have on the returns to land, family labor, and other factors of production employed on typical cattle ranches and feed-lot operations. In general, the results indicated that most of the impact would fall on fixed assets such as real estate.

The major conclusion which emerges from this study is that the quota brings only modest benefits to U. S. beef producers; furthermore, the slightly higher level of prices resulting from import restrictions has been capitalized into the value of farms and ranches. When considered in the light of the adverse effect on consumers, in terms of reduced quantities available for purchase and higher prices, and on those countries supplying imports, in terms of lost foreign exchange earnings, the quota as a means of improving the incomes of beef producers has little in its favor.

Fred J. Durant, *Economic Analysis of Financial Growth Strategies for Large Pennsylvania Dairy Farms Under Competitive Labor Con-*

ditions, The Pennsylvania State University, 1971.

The effect of three financial management strategies on the rate of growth of a large Pennsylvania dairy farm was studied. It was assumed that the firm would be competing with non-farm industries in the labor market in terms of wage rates and working conditions. The three strategies compared were: (1) a high equity strategy reflecting severe internal capital rationing, (2) a low equity strategy reflecting minimum equity ratios imposed by credit institutions, and (3) a second low equity strategy where equipment was leased rather than purchased during the growth period. The effect on growth rates of high reservation prices for capital and labor were also investigated.

The growth of the firm was simulated using a two-stage recursive linear programming model.

Specifically, the steps were as follows:

1. Solve the long-run planning model for year $t + 1$. Restraints in this model include the resources available at the beginning of year t and the minimum equity ratios. The capital resource was cash available plus remaining borrowing capacity and borrowing capacity generated by capital purchases. Activities include land acquisition, building expansion, machinery and equipment acquisition, herd expansion, and cropping program. Labor was parametrized to find the optimum complement of full-time and overtime labor. Reservation prices were incorporated for labor and capital.

2. The results were examined to see if planned herd expansion, silo construction, or land acquisition (purchase or rental) was greater than or equal to the minimum levels permitted. If none of the minimums could be met, it was assumed that the planning model called for no expansion.

3. The land, livestock, building and machinery purchases, and the feed production program, necessary in year t to get planned production in year $t + 1$ was determined. If adequate capital for the planned expansion was not available, the planned expansion was again scaled down to what could be financed. If the reduced expansion was less than the minimum levels permitted, it was assumed that no expansion occurred.

4. The operating linear programming model for year t was solved with results of step (3) as additional restraints. This operating model was primarily an accounting model used to determine net income tax, and ending cash balances. However, labor was parametrized to find the optimum combination of full-time and overtime labor.

5. The resource base was updated by calculating new principle and interest payments and withdrawals for family living in year $t + 1$ as a function of net farm income in year t .

6. The process was repeated with $t + 1$ as the base year.

The results show that maintenance of high equity ratios greatly reduces the rate of growth in early years. The most limiting factor under the low equity strategy is the ability of an investment to generate enough cash to meet total debt service payments. Firm growth can be achieved at a faster rate using the low equity strategy when equipment is leased during the expansionary period. However, purchase options should be considered after the growth period if no tax-saving benefits can be derived from a lease program. Results also show that it can be profitable to increase herd size while competing with non-farm industries in terms of wage rates and working conditions, and that reservation prices on capital and labor used as insurance against risks and uncertainties will reduce growth, especially when a low equity strategy is used.

William D. Ricker, *An Analytical Approach to the Consolidation of Counties in North and West Florida Based on Educational Efficiency Criteria*, University of Florida, 1971.

This paper proposes a methodology for consolidation of the 29 counties in north and west Florida. Public primary and secondary education in Florida is examined in an economies of size study to determine the effect of consolidation of counties on educational expenditures. A multiple linear regression analysis is used to adjust expenditure data to reflect only administrative and in-school costs and to examine the relationship between expenditure per pupil and average daily attendance.

A linear programming model using cost coefficients derived from the economies of size study determines the optimum (least cost) combination of counties from among 148 selected feasible combinations. Five separate solutions are generated with the program to reflect differences in the maximum number of counties allowed in a combination.

The projected annual savings of in-school costs as a result of consolidation range from \$600,000 for a plan containing 16 counties to \$1,426,000 for a plan containing 7 counties. The possibility of greater savings resulting from consolidation as well as the extension of the methodology to include other services of county governments is also discussed.

of \$1,920.57 was sold at \$18,112.88, or at a total of \$26,843.30 for the stock. Also, all of our corporate bonds which cost \$22,936.91 were sold for \$15,821.95. These receipts, together with \$104.68 from earnings, were used to purchase 250 shares of American Cyanamid for \$9,143.43, 500 shares of Goodyear for \$16,692.50, and 300 shares of American T&T (\$4 CV pfd) for \$16,934.00. The total of purchases amounted to \$42,769.93.

It is to be noted that the revision in the portfolio resulted in a much higher value because more current values were used. This revision also produced an income which was referred to in the Secretary-Treasurer's report.

During the year, our investments in stocks produced \$6,426.42 in dividends and our corporate bonds produced an interest income of \$584.15, or a total of \$7,010.57. Three of our stocks—AT&T, Continental Can, and Texaco—were worth less at the end of the year than at the beginning (Table 3).

The AAEEA investments are not particularly large. They are badly needed not only to produce income to meet current operating expenses but also to stabilize our activities and to provide a credit rating which will enable the Association to conduct its business in a convenient fashion.

Respectfully submitted,
JOHN C. REDMAN,
for the Investment Committee

REPORT OF THE EDITOR

AJAE editors, much like growth-oriented food processors, have a certain mania for differentiating their product from their rivals and/or predecessors. Varden Fuller, as the previous editor, instituted a number of significant changes, such as an increase from a one- to a two-column format, introduction of the Research Notes section, a restylized News Notes section, and a change in the color of the *Journal's* cover. In an attempt to gain additional acceptance and readability the editors of the 1972 volume have created a Short Articles/Notes section (displacing the previous Research Notes section), developed and published regularly (on the inside front cover) an editorial policy statement to orient prospective authors, abstracted each Short Article or Note with approximately 50 words or less, and altered (again) the color of the *Journal's* cover. Other minor changes have included a listing of doctoral degrees by both subject area and institution, identification of the *Journal* and month of publication on alternative pages, and a more extensive annual subject matter index (forthcoming in the December issue).

The editor's plea for relatively more high quality submissions from the business, extension, and teaching phases of agricultural economics has not as yet translated itself into a broadening of the *Journal's* scope. The bulk of the AJAE submissions continue to be research-oriented though the Short Articles/

Table 1. New AJAE submissions, manuscripts accepted, and the acceptance rate, 1960/61-1971/72

Period	Number of New Submissions ^a	Number of Manuscripts Accepted for Publication	Manuscripts Accepted as a Percent of New Submissions
1960/61	140 ^b	70 ^b	50 ^b
1961/62	140 ^b	70 ^b	50 ^b
1962/63	167	77	46
1963/64	162	77	48
1964/65	184	80	43
1965/66	218	87	40
1966/67	195	96	49
1967/68	212	100	47
1968/69	268	105 ^b	39 ^b
1969/70	249	95 ^b	38
1970/71	250	96 ^b	38
1971/72	264	96	36

^a Excludes proceedings papers and book reviews.

^b Estimated.

Notes section has been designed to accommodate a wide variety of materials.

In the first year of operation the new editors received 264 new submissions, plus a carryover of 49 partially evaluated manuscripts from the Fuller-Carter-Dean era. Thus, there was a stock of 313 papers from which to select articles, short articles, notes, and communications for the 1972 volume. These numbers, of course, exclude book reviews and the manuscripts published as proceedings papers in the May and December issues.

The level of new AJAE submissions has almost doubled since the early 1960's (Table 1), although the recent change in editorship did not produce a surge or elevated plateau of submissions as hypothesized by Fuller. While the number of papers accepted for publication has generally increased over time, the rate of increase has been such that there has been a steadily declining acceptance rate over the past 12 years (from 50 percent in 1960/61 to 36 percent in 1971/72). Compared with the 14 percent acceptance rate reported for *The American Economic Review* in 1971, the AJAE still provides authors with a reasonable chance of publication.

Comparing Volumes 53 (1971) and 54 (1972), the total number of refereed papers published was identical, but the mix between various types of papers

Table 2. Number of AJAE articles, notes, and communications published, excluding proceedings papers and book reviews, 1971 and 1972

Type of Paper	1971	1972
Articles	41	30
Research Notes	23	—
Short Articles/Notes	—	37
Communications	32	29
Total	96	96

Table 3. AJAE reviewers, Volume 54

Reviewer	Reviewer	Reviewer	Reviewer
Jay Anderson	Robert S. Firsch	George W. Ladd	LeRoy F. Rogers
Christopher O. Andrew	John Fliginger	Larry N. Langemeier	L. L. Sammet
Jere R. Behrman	Robert L. Freie	Lawrence J. Lau	Andrew Schmitz
Arlo W. Biere	Wayne A. Fuller	John E. Lee, Jr.	Lee F. Schrader
Harold Black	Hazen F. Gale	T. C. Lee	Ronald A. Schrimper
O. P. Blaich	Bruce D. Gardner	Edna Loehman	Leonard W. Schruben
Leo V. Blakley	P. S. George	Samuel H. Logan	T. W. Schultz
James Boles	N. Georgescu-Roegen	Alexander F. McCalla	John T. Scott
James T. Bonnen	John Gerber	Edward L. McClelland	James A. Seagraves
W. Kenneth Boutwell, Jr.	Kenneth C. Gibbs	James I. McDowell	S. K. Seaver
George E. Brandow	Roger W. Gray	Dean E. McKee	James D. Shaffer
Daniel W. Bromley	Jack Greenfield	William L. McKillop	Jerry H. Sharples
Robert C. Brown	J. R. Greenman	W. K. McPherson	E. T. Shaudys
William G. Brown	Gene W. Gruver	W. W. McPherson	Richard L. Simmons
W. Keith Bryant	Leo J. Guedry	J. Patrick Madden	J. Marvin Skadberg
Oscar R. Burt	Thomas F. Hady	Lester V. Manderscheid	Blair J. Smith
Ronald Callander	Harold G. Halcrow	Jitendar S. Mann	Cecil N. Smith
Joe R. Campbell	Albert N. Halter	Jesse W. Markham	Eldon D. Smith
Wilfred V. Candler	Joseph Havlicek, Jr.	James E. Martin	Frank J. Smith, Jr.
Hoy F. Carman	Marvin L. Hayenga	Yoshihiro Maruyama	J. Herbert Snyder
A. Barry Carr	P. B. R. Hazell	Gene A. Mathia	R. G. Spitzer
John S. Chipman	Earl O. Heady	Jimmy L. Matthews	James L. Stallings
David A. Clarke	John H. Herbst	George L. Mehren	J. B. Stevens
Willard W. Cochran	William M. Herr	J. W. Mellor	Frederick D. Stocker
Norman R. Collins	Stephen J. Hiemstra	Arlo Minden	John G. Stovall
Dale K. Colyer	Thomas A. Hieronymus	Clyde E. Murphree	Gene D. Sullivan
J. Richard Conner	Lowell D. Hill	Frank W. Musgrave	Paul E. Sultan
Hugh L. Cook	Roger P. Hill	R. J. Mutti	Earl R. Swanson
James Copp	Royce A. Hinton	Lester H. Myers	Anthony M. Tang
Keith Cowling	Hans G. Hirsch	James Nix	John R. Tedford
Dana G. Dalrymple	James C. Hite	Richard B. Norgaard	K. R. Tefertiller
Rex F. Daly	Irving J. Hoch	David W. Parvin, Jr.	William G. Tomek
Ralph C. D'Arge	I. I. Holland	E. L. Pasour	William D. Toussaint
Richard H. Day	John Holt	Allen B. Paul	Luther G. Tweeten
Carleton C. Dennis	Dale M. Hoover	Iby Pedrosa	Fred H. Tyner
Raymond A. Dietrich	John A. Hopkin	John Penson	Edward W. Tyrczniewicz
John L. Dillon	James F. Hudson	Willis L. Peterson	M. Louis Upchurch
Gerald A. Doeksen	Verner G. Hurt	Travis D. Phillips	Alberto Valdes
John P. Doll	Leroy J. Hushak	James S. Plaxico	James Vermeer
Peter P. Dornier	George D. Irwin	Anthony A. Prato	Ronald W. Ward
Folke Dovring	Robert E. Jacobson	Frederick J. Prochaska	Frederick V. Waugh
Bobby R. Eddleman	Alain de Janvry	J. C. Purcell	Finis R. Welch
W. F. Edwards	D. Gale Johnson	G. G. Quackenbush	J. G. West
Ludwig M. Eisgruber	Paul R. Johnson	Alan Randall	Andrew Whinston
Robert D. Emerson	Stanley R. Johnson	Richard C. Raulerson	Robert B. Wilson
Bernard L. Erven	Robert L. Johnstone	Philip M. Raup	Larry J. Wipf
Robert E. Evenson	L. L. Jones	Gordon Rausser	Mark Yang
Nelson Fairbanks	Gordon A. King	Daryll Ray	Dan Yaron
Walter P. Falcon	Richard A. King	Franklin J. Reiss	Robert Zellner
J. Edwin Faris	Jan Kmenta	John E. Reynolds	Glenn A. Zepp
Lyle P. Fettig	William E. Kost	Terry L. Roe	Pinhas Zusman
Robert M. Finley	Ronald D. Laceywell		

was different. The 1972 volume represents a decreased number of full articles and communications, while the number of Short Articles and Notes published in 1972 greatly exceeded the number of Research Notes published in 1971 (Table 2).

The *American Journal of Agricultural Economics* is blessed with an abundance of expert assistance from a wide variety of sources. Much of the success of Volume 54 is particularly due to highly skilled services of Max R. Langham, the Associate Editor. Our Editorial Assistant, Carole Oglesby, has accomplished her varied and time-demanding jobs most

effectively and efficiently. The work of Cindy Bass, the *Journal* Secretary, has been first rate. Peter G. Helmberger, AJAE Book Review Editor, has provided readers with selections that were of general and timely interest, as well as editing for brevity and conciseness. In addition to their extensive manuscript evaluation function, members of the Editorial Council also advised the Gainesville editorial staff regarding various editorial policies and read, evaluated, and ranked their choices for the Outstanding Journal Article for 1971. Members of the 1972 Editorial Council were: Ludwig Auer, Michael Brewer,

Clark Edwards, Vernon R. Eidman, Kenneth R. Farrell, Lehman B. Fletcher, Yujiro Hayami, Bruce F. Johnston, Marvin W. Kottke, Arthur B. Mackie, William E. Martin, Daniel I. Padberg, Roy G. Stout, Takashi Takayama, Henry A. Wadsworth, and Francis E. Walker. Finally, the editors are genuinely grateful to more than 200 other professionals who reviewed AJAE submissions anonymously and provided an essential basis for editorial decisions regarding publication. As a meager token of our appreciation for their efforts, these reviewers for the 1971 Volume are revealed in Table 3. (The list is *not* exhaustive of the "countless" colleagues who also provided evaluative comments directly or indirectly to our designated reviewers.)

LEO POLOPOLUS, *Editor*

REPORT OF THE AWARDS COMMITTEE

The annual report of the Awards Committees can be briefly outlined in terms of receipt and disposition of contestants in five categories of awards: extension, undergraduate teaching, master's theses, doctoral dissertations, and published research.

Extension Awards

One winner was selected from 10 nominations for the award for Distinguished Extension Program. The judging committee reported close competition among the top three contenders.

Undergraduate Teaching Awards

Ten nominations were made in the senior category: 10 or more years of service. Eight were nominated in the junior category: less than 10 years of service. The quality of nominations was generally high. One winner was selected in each category.

Master's Theses

Twenty-five entries were judged. Two more were received but were too late to be considered in this year's contest. A special problem was generated this year by the loss of two theses in a mail shipment. However, the loss did not affect any final outcomes.

Doctoral Dissertations

Twenty-nine entries were judged. Three institutions were allowed two entries each. The remaining 23 were distributed over 23 institutions. The judging committee reported a close grouping of five theses at the top, with especially close competition among the third, fourth, and fifth place entries. Honorable mention was given to the latter two.

Published Research

Twenty-two entries were judged. All of the top five and seven of the top ten had at least one author over 40 years of age.

Respectfully submitted,
C. B. BAKER, *General Chairman*

AWARD WINNERS

DISTINGUISHED EXTENSION PROGRAM

EDWARD A. LUTZ, *In-Service Training of County Officers in County Government Coordination and Management*, Cornell University

DISTINGUISHED EXTENSION PUBLICATION

HAROLD F. BREIMYER, University of Missouri, and WALLACE BARR, Ohio State University, *Bargaining in Agriculture—Potentials and Pitfalls in Collective Action*, North Central Regional Publication 30, University of Missouri Extension Division Circular C911, June 1971.

DISTINGUISHED UNDERGRADUATE TEACHING AWARDS

Less than 10 years:

W. D. DOWNEY, associate professor, Purdue University, Agricultural Economics 330 and 331, *Agricultural Business Management*

10 or more years:

R. G. F. SPITZE, professor, University of Illinois, Agricultural Economics 305, *Agricultural Policies and Programs*

UNPUBLISHED RESEARCH AWARDS

Doctoral Theses

RAUL E. YVER, *The Investment Behavior and Supply Response of the Cattle Industry in Argentina*, University of Chicago; advisor: H. Gregg Lewis. Deceased.

CHARLES K. MANN, *Taste, Technology and the Government: The Case of Tobacco*, Harvard University; advisor: Walter P. Falcon. Currently with USAID, Turkey.

DAVID M. BELL, *The Impact of Air Pollution Abatement Activities of Coal-Burning Electric Power Generating Plants on the Fertilizer Industry*, Michigan State University; advisors: James D. Shaffer and David Armstrong. Currently with the Marketing Economics Division, ERS, USDA, Washington, D.C.

Honorable mention:

MARIO KAMINSKY, *The Structure of Production of Multiple-Output Dairy Farms in the "Centro Santafecino" Region of Argentina: A Multivariate Analysis*, University of Wisconsin; advisor: Rueben C. Buse. Currently with the Ford Foundation in Argentina.

GERALD ARTHUR DOEKSEN, *A Social Accounting System and Simulation Model Projecting Economic Variables and Analyzing the Structure of the Oklahoma Economy*, Oklahoma State University; advisor: Dean F. Schreiner. Currently with the Economic Development Division, ERS, USDA, stationed at Oklahoma State University.

Master's Theses

GEOFFREY HARVEY JACKSON, *An Economic Analysis of the Quota on United States Beef Imports*, Cornell University; advisor: Kenneth L. Robinson. Currently a doctoral degree student in agricultural economics, Cornell University.

FREDERICK J. DURANT, *Economic Analysis of Financial Growth Strategies for Large Pennsylvania Dairy Farms Under Competitive Labor Conditions*, Pennsylvania State University; advisor: Earl J. Partenheimer.

WILLIAM D. RICKER, JR., *An Analytical Approach to the Consolidation of Counties of North and West Florida Based on Educational Efficiency Criteria*, University of Florida; advisor: Fred H. Tyner. Currently a staff member at the University of Mississippi.

PUBLISHED RESEARCH AWARDS

P. S. GEORGE and G. A. KING, *Consumer Demand for Food Commodities in the United States with Projections for 1980*, Giannini Foundation Monograph 26, March 1971.

BRUCE B. BEATTIE, EMERY N. CASTLE, WILLIAM G. BROWN, and WADE GRIFFIN, *Economic Consequences of Interbasin Water Transfer*, Technical Bulletin 116, Oregon State University, June 1971.

W. D. DOBSON and E. M. BABE, *An Analysis of Alternative Price Structures and Intermarket Competition in Federal Order Milk Markets*, Research Bulletin 870, Purdue University, December 1970 (received from printer March 31, 1971).

OUTSTANDING ARTICLE IN AJAE

JEAN-MARC BOUSSARD, "Time Horizon, Objective Function, and Uncertainty in a Multi-period Model of Firm Growth," *Am. J. Agr. Econ.* 53:467-477, Aug. 1971. Currently, Charge, Institut National de La Recherche, Agronomique Economie et Sociologie Rurales, Paris.

REPORT OF THE COMMITTEE ON ECONOMIC STATISTICS

The Committee first met in July 1970 to begin exploring the data systems problems which we face as a profession. This was pursued in subsequent sessions and in a seminar on "The Problems of Metropolitan and Non-Metropolitan Social and Economic Statistics," which the Committee organized and sponsored in Washington, D.C., on December 18, 1970. Participating in the seminar in addition to the Committee were Guy Orcutt of Yale University, Mancur Olson of the University of Maryland, Brian Berry of the University of Chicago, Mike Brewer of Resources for the Future, Conrad Taeuber and Tom Breen of Census, Julius Shiskin of Office of Management and Budget, Donald Shoup of the Social Science Research Council, William Pendleton of the Ford Foundation, and Thomas Juster of the National Bureau of Economic Research. The Bureau of

the Census made this seminar possible by financing the travel expenses of those who could not otherwise attend. The seminar was quite useful in identifying issues and major dimensions of our data systems problem, as well as the diverse perceptions of data problems that prevail. At this point it was clear that we had taken on a very large and complex task—intellectually and otherwise.

Over the subsequent 18 months the Committee has tried to develop its own definition of the nature of the major data problems to be faced and its approach to these difficulties. We have concluded that the fundamental problem lies in (1) obsolescence of the concepts presently being quantified by our data systems and (2) the great increase in need for new types of data which current data systems were not designed to provide. In either case, we must start with the development or identification of the body of economic or social science theory and its conceptual entities which require quantification. The task before the profession is that of reconceptualizing the primary data systems for rural economic and social decision making. The Committee has attempted to define the problem and this task in a progress report to the Association. This report takes the form of a major seminar session paper, "Our Obsolete Data Systems: New Directions and Opportunities," drafted by the Committee and presented at the August 1972 Association meetings in Gainesville, Florida. The report is published elsewhere in this issue of the *American Journal of Agricultural Economics*.

Because of the scale of the undertaking and its obvious separability, the Committee has decided to factor itself into two task forces in pursuing the rest of its obligations. These are the "Task Force on Food and Fiber Industry Statistics" chaired by James Hildreth and the "Task Force on Social and Economic Statistics for Rural Areas" chaired by George Tolley. The composition of these task forces and their immediate objectives were discussed and tentatively outlined at the last meeting of the Economic Statistics Committee in Chicago on December 7, 1971. In addition to the long-run task of reconceptualizing our data systems, these task forces will attempt in the near future to input into (a) decisions on the Census of Agriculture where some fundamental changes in what is being measured are currently under consideration and into (b) the decisions on "what social indicators can be constructed from present data" that appear headed for conclusion and action soon within the Office of Management and Budget.

Respectfully submitted,
JAMES T. BONNEN, *Chairman*

REPORT OF THE EDUCATION COMMITTEE**Workshop**

The main activity of the Education Committee for 1971-72 was to arrange and conduct a workshop on

the improvement of education in agricultural economics. A subcommittee, consisting of John Helmsberger (chairman), A. C. Hoffman, and Lester Manderscheid, did an outstanding job in planning the workshop which was held in conjunction with the annual meeting in Gainesville, Florida.

Because of the importance of curriculum in the educational process, curriculum development was selected as the central theme of the workshop. Other topics covered were goals of higher education, the market for agricultural economists, improvement of instruction, and evaluation and rewarding of good teaching performance. Four roundtable discussions gave participants an opportunity to consider educational needs of students preparing for careers in business, extension and other public service, research, and teaching.

Speakers and resource persons were drawn from a wide distribution within the profession and from outside agricultural economics. Participation in the workshop was by invitation. Participation was invited from land grant and non-land grant colleges and universities offering degrees in agricultural economics, from business and industry, and from the USDA and other agencies of federal government. Excellent cooperation was received from the Industry Committee in inviting industry participants and in conducting a survey of agribusiness firms specifically for the workshop. The Education Committee considered 75 the optimum number of participants to provide opportunity for in-depth discussion. The chairman of the Student Affairs Committee and six students participated in the workshop. The total number of participants, including speakers, was 108.

Each participant in the workshop was charged a \$25 fee to cover mailing, printing, outside speakers, and other costs of conducting the workshop.

An evaluation of the workshop was conducted by a subcommittee consisting of John McNeely (chairman), John Wildermuth, Carroll Hess, and John Reynolds.

In line with action taken by the Executive Board in August 1971, proceedings of the workshop will be published as a supplement to AJAE and distributed to all members. Fred Mangum is serving as editor of the proceedings.

Survey of Curriculum Changes

At the 1971 annual meeting, the Executive Board directed the Committee to conduct an annual survey of curricular changes in agricultural economics and make the information available to interested institutions and individuals. Eldon Weeks accepted responsibility for the survey which is being done in two parts. Part I, completed in 1971-72, will relate to course work offerings. Part II, which will cover changes in curriculum structure, is planned for 1972-73.

Respectfully submitted,
JAMES NIELSON, *Chairman*

REPORT OF THE INDUSTRY COMMITTEE

The committee met in December 1971 and again in March 1972 to consider the contribution that industry could make to the ongoing activities of the Association as well as specific participation in the Education Workshop scheduled to follow the 1972 meetings.

We wrestled with but did not resolve the subject of interchange of personnel between industry, government, and education. The unanimous view that such a program has merit suggests that a special committee should be appointed to determine the specific limitations and to develop a program to implement this exchange.

The committee wholeheartedly supports the view that industry has something to contribute to the Association and willingly accepts the responsibility that goes with an active role. The increased number of industry participants in the general program serves as evidence of this mutual acceptance.

The entire committee cooperated with the Workshop Subcommittee to obtain industry participants. Despite last-minute cancellations, 11 industry representatives were in attendance at the workshop. We believe this experience was enlightening to those in attendance, and we shall endeavor to communicate those reactions to our professional colleagues in industry.

We assisted board member McKee in conducting a survey of industry utilization of agricultural economists and solicited suggestions for improved training to meet current needs. The results of that survey served as the basis for the paper delivered by McKee at the workshop.

As a committee, we do not have a lengthy list of tangible accomplishments; however, I firmly believe we have made significant contributions in numerous but subtle ways. For instance, in connection with the McKee survey, more than 300 letters were mailed to people in industry calling attention to the Association and its desire to modify educational programs to meet the needs of employers of agricultural economists. Likewise, contact was made with many prospective workshop participants who, though unable to accept, were made aware of the Association and some of its activities for the first time. Depending upon their reaction to our overtures, the "publicity" for the Association may have been good or bad. I feel confident that the impact was positive.

I have felt privileged to serve as a member of this committee for a number of years and to be its chairman for the past two. I believe the Association has been extremely generous in its acceptance of our suggestions. Quite obviously, an improvement in the lines of communication between professionals in education, government, and industry can do nothing but benefit all. I am confident that those industry representative who serve in future years will continue to

value the opportunity and give their very best efforts to furthering the objectives of the Association.

Respectfully submitted,
CHARLES E. ERICKSON, *Chairman*

REPORT OF THE COMMITTEE ON INTERNATIONAL ACTIVITIES

The committee met in New Orleans in December 1971 in connection with the AAEA meetings. In addition, the chairman of the committee had a number of contacts with the president and other members of the association on various issues falling within the domain of the committee.

At the New Orleans meeting Wyn Owen reported on the status of the Economic Institute at the University of Colorado. He mentioned that the interest in agricultural economics on the part of foreign graduate students attending the Institute had increased considerably. Enrollment in courses dealing with agricultural economics and development matters has likewise grown. The committee felt that the Institute was performing a very useful service which should be continued. It was therefore recommended that the Association go on record to support an application for a continuation of the financial support given to the Economic Institution by the Ford Foundation. The President of the Association was asked by the committee to write a letter of support to the Ford Foundation.

The program of work of the "Research Training Network" (RTN) of the Agricultural Development Council was reviewed in detail. The committee was impressed at the scope and quality of that program and felt it was making an important contribution to agricultural development.

Wayne Schutjer reported that on the basis of his experience with the Research and Training Network he had become convinced of the need for a small grants program in agricultural development. Scholars located at universities with relatively large AID contracts have access to research funding for specific problems and also tend to have some flexibility to explore new and related areas. The same is not true of younger, less established men and economists located at universities with more limited international programs.

The other members of the committee agreed that a small grants program was needed and would have a high payoff in terms of research output per dollar. The committee members discussed three additional groups who would benefit substantially from a small grants program: (1) general economists, (2) thesis advisers, and (3) scholars without LDC contacts.

Wyn Owen reported that general economists were placing increasing importance on the agricultural sector and, hence, upon research related to agriculture. General economists, however, often do not have either the contacts with established economists or research funds to undertake the needed research. The same applies to many agricultural economists at

smaller institutions. A small grants program could be used to overcome both barriers to effective research through domestic and foreign travel grants. A second group identified as potential beneficiaries of a small grants program were advisers whose students have obtained a grant to undertake research abroad. In these instances a small research grant would enable the professor to accompany his student during the initial stages of field work.

The rising LDC nationalism toward social science research can in large part be overcome by cooperative research between LDC and U.S. scholars. However, the cooperation must include all stages of the research—from problem identification through policy implications. Thus, it is no longer satisfactory for a U.S. scholar to define the problem, seek funding, and then approach a host country counterpart regarding his cooperation. Current funding arrangements in general do not facilitate cooperation at the formative stages; thus, in general, funding is available only when a specific and complete proposal is submitted. A small grants program could overcome this deficiency in current research funding arrangements by providing international travel grants for exploratory discussion and the cooperative drafting of research proposals.

A related need cited by the committee is for a greater exposure of foreign visitors to the U.S. academic community. Thus, many foreign scholars serve as visiting professors in U.S. colleges and universities or on short-term assignments with an international agency located in the U.S. A small grants program could be utilized to provide travel grants (in the U.S.) to ensure that these scholars interact with a broader segment of the academic community than would be possible at their host institutions.

Wayne Schutjer has agreed to draft a proposal for a small grants program which can serve as the basis for further discussion by the committee.

Finally, the committee felt that it would be desirable to prepare and maintain an up-to-date listing of foreign visiting agricultural economists in the U.S. This task might be one of the priority activities of the committee in 1972-73.

Erik Thorbecke, after serving two years as chairman of the committee, asked to be relieved, since he will be abroad during 1972-73.

Respectfully submitted,
ERIK THORBECKE, *Chairman*

REPORT OF THE MEMBERSHIP COMMITTEE

We had a considerable recovery in membership by the end of 1971 after the fall-off when the dues were increased. Part of this was due to this being the Handbook-Directory year. But much of the increase was due to the willingness of the membership representatives at each university, college, or government division to take the responsibility to advertise AAEA

and invite their colleagues to join their professional organization.

This was the procedure we used again this year to have a membership representative designated at each institution. Excellent cooperation was received. We had response from most of the institutions. Many chairmen took this responsibility themselves.

John Redman has done an excellent job in following through on delinquent members. They were contacted at least five times before they were dropped from the roles. This persistent effort paid off with several even paying last year's dues! We had a significant number of regular members from the United States and a significant recovery in our junior U.S. membership. (We had asked our membership representatives to give special attention to graduate students.) Our foreign membership continues to decline, principally because of the reduction in trainees sponsored by AID.

We did have a recovery on library subscriptions. This fell off with the increase in price, and we asked our representatives to make a special effort to restore the *Journal* into their libraries. We had a record number of foreign libraries and businesses receiving the *Journal*.

Respectfully submitted,
QUENTIN M. WEST, *Chairman*

REPORT OF THE PROFESSIONAL ACTIVITIES COMMITTEE

1. The Committee commends and urges effective continuation of Bonnen's Committee on Agricultural Statistics and Related Information.

2. The Committee recommends a committee, appointed by the president, to review the public-private sector benefit-cost considerations of regulatory bodies like EPA. We are concerned about uncoordinated responses to environmental regulations covering agricultural chemicals, burning, sanitation, drainage, etc., which may result in isolate actions instead of fostering systematic coordination among federal, state, local, and professional agencies. To further our concern, many questions of interest to regulatory agencies have social science aspects which are sometimes overlooked in favor of technical physical science solutions.

3. We urge the AAEA membership and its officers to consider soliciting sponsorship of a small group to review and evaluate the evolving articulation of the land grant philosophy, the role and structure of our Association within this philosophy and the future role and functions of our profession within this framework. Additional questions which might also be addressed include what should the Association's relationship be with other professional, foundation-spon-

BRIEF STATUS REPORT ON AAEA POSTWAR LITERATURE REVIEW

Chapter	Chapter outline solicited	Outline approved	Reviewers invited	Reviewers committed	Working outline received	Draft status
I Introduction		To be written by committee				
II Agricultural economics in relation to economics	X	not settled				
III Analytical techniques	X	X		Judge, Leader		
A. Estimation techniques			X	Judge	X	In hand ¹
B. Optimization techniques			X	Day		Early in 1973
C. Simulation techniques			X	Rausser & Stan Johnson	X	In hand ²
IV Philosophical foundations	X	X	X	Glenn Johnson	X	1973
V Agricultural economics data	X	X	X	Trelogan and Abel ³	X	1973
VI Farm management	X	X	X	Harald Jensen	X	July 1973 ⁴
VII Agricultural marketing						
A. Plant and firm efficiency			X	Ben French	X	Late in 1972
B. Industrial organization			X	Helmberger & Mueller		1973
C. Consumption	X	not settled				
VIII Agricultural finance	X	X	X	Brake and Melichar		Early in 1973
IX Price analysis	X	X	X	Robinson & Tomek	X	Late in 1972
X Agricultural policy	X	X				
A. Commercial farm policy			X	Brandow	X	Late in 1972
B. Policy on international trade in agricultural products			X	Gale Johnson		Late in 1972
XI Resource economics	X	X	X	Castle-Kelso-Stevens-Stoevener		1974
XII Human resources	Tentatively scratched—final			consideration due		
XIII Technical change	X	X	X	Peterson & Hayami	X	Late in 1972
XIV Rural poverty	X	X	X	Bawden & Bryant	X	1973
XV Rural people, communities and regions	X	X	X	Tolley, Leader		
A. Economic basis for growth			X			
B. Community studies			X	Gamble, Jansma, Madden		1973
C. Population distribution			X	Clawson		
XVI Agricultural growth	X	X	X	Eicher		1973
A. Africa				Mellor		1973
B. Asia				Schuh		1973
C. Latin America						

¹ Now being reviewed for the committee by George Kuznets and Wayne Fuller.

² Now being reviewed for the committee by Ludwig Elagruber, Al Halter, and Tom Naylor.

³ Dr. Houseman has retired from USDA and will contribute substantially to the review, but he has asked to be relieved of overall responsibility for the review article.

⁴ Professor Jensen had a draft in July but has been waiting for suggestions from his reviewers before submitting a revised draft to the committee. A draft is anticipated in October or November.

Respectfully submitted,
LEE R. MARTIN, *Chairman*

Financial report

	1970	1971	1972	Estimated Request 1973
Cash awards	\$600.00	\$ 600.00	\$ 600.00	\$ 600.00
Judges' honorariums	200.00	300.00	300.00	300.00
Newsletters and pictures	100.00	150.00	150.00	150.00
Plaques, keys, engraving	70.00	70.00	70.00	70.00
Printing and miscellaneous	20.00	20.00	20.00	20.00
	<u>\$990.00</u>	<u>\$1,140.00</u>	<u>\$1,140.00</u>	<u>\$1,140.00</u>
Sale of Shingles	45.75	24.50	25.00	25.00
Charter fees	135.00	45.00	20.00	20.00
SS-AAEA balance forward	61.40	172.68	—	—

Respectfully submitted,
JOHN SJO, *Chairman*

sored, public, or privately sponsored groups and organizations whose interests touch the profession? In the latter context, we urge the Association to explore the possibility of alternative forms of communication other than our *Journal*, i.e., what are they, to whom would they go, would they be more effective than what we now have, etc.?

4. In much the same vein as above, we recommend that the AAEA appoint a committee to rethink the profession's contribution toward rural development and our relationship to other professionals engaged in this area. Further, what are the Association's opportunities to work with non-land grant schools and colleges (i.e., community colleges, state schools, etc.) in rural development and other resource-related areas? We believe additional intellectual input is needed to reduce the random *ad hoc* approach that sometimes now exists.

5. We note some membership concern that an Association of our size does not employ a full-time executive secretary and journal editor. Because of an expressed desire to expand professional and academic participation in AAEA, perhaps a committee might be formed to review the reason for this concern and make recommendations which could take effect when the Association moves to its next secretary-treasurer and editor.

Respectfully submitted,
L. T. WALLACE, *Chairman*

REPORT OF THE STUDENT AFFAIRS COMMITTEE

The principal activity of the Student Affairs Committee during 1971-72 was assisting the student section in its program and contests.

Winners of the debate contest were:

First: JOHN GROSS and RICK BROCH, Purdue University; Henry Courtenay, coach.
Second: LEON SPAETH and KRIEG FAILING, Montana State University; Gail L. Cramer, coach.
Honorable Mention: EDDIE MILLER and STEPHEN MATHIS, Oklahoma State University; John Riley and Dan Badger, coaches.

Honorable Mention: MERCER TURNER and RANDY MARTEN, University of Illinois; D. G. Smith and S. C. Schmidt, coaches.

The winners of the speech contest were:

First: GARY J. WILLIAMS, Oklahoma State University

Second: DALE MINNICK, JR., Oklahoma State University

Third: ANDREW KRUTSINGER, Michigan State University

Honorable Mention: ROBERT CRAIG, Michigan State University

Honorable Mention: WILLIAM H. DAVIS, University of Georgia.

The winners of the essay contest were:

First: JOHN E. WOOD, Oklahoma State University

Second: MARK ELLIOT, Oklahoma State University

Third: TURNER GRAVITT, University of Kentucky

Honorable Mention: ROY A. JOHNSON, University of Minnesota

Honorable Mention: WAYNE GILLESPIE, Montana State University.

The Student Section Officers for 1972-73 are:

President: EDDIE MILLER, Oklahoma State University

Vice-President: COLEMAN HADDEN, University of Georgia

Secretary-Treasurer: BILL PRICE, Texas Tech University

Editor: GARY J. WILLIAMS, Oklahoma State University

Directors: STEVE MATHIS, Oklahoma State University; MERCER TURNER, University of Illinois; RICK BROCH, Purdue University; RUSS DUECHLAR, Iowa State University; ROGER JOHNSON, North Dakota State University; KEN HARLING, Guelph University; WAYNE GILLESPIE, Montana State University

REPORT OF THE AD HOC COMMITTEE ON THE SUSTAINING MEMBERSHIP CLASSIFICATION

It is the recommendation of the committee that the present membership classification of *Sustaining Member* provided in the bylaws of the American Agricultural Economics Association be eliminated and be replaced by a classification of membership designated as *Institutional Member*. In accordance with this recommendation the bylaws of the American Agricultural Economics Association should be amended to read as follows:

Article II, Section 2d. Each institutional member may designate up to three (3) representatives who shall be regarded as, and enjoy the same privileges as, regular members. Any person, firm, corporation, association, group or partnership may become an institutional member upon payment of such sum as may be fixed from time-to-time by resolution of the Executive Board.

Article III, Section 1d. Institutional Membership—\$100.00

Voting rights under the Institutional Membership would be exercised by the designated representatives in their capacity as regular members of the association. Each representative designated under the Institutional Membership would also receive a subscription to the *American Journal of Agricultural Economics*.

In order to promote the Institutional Memberships, the committee encourages the Association to use the revenues realized from the Institutional Memberships to support professional activities of the Association that would be of interest to and of benefit to the Institutional members. These might well take the form of training workshops or seminars on topics of immediate interest to the Institutional members.

DEAN E. MCKEE, *Chairman*

REPORT OF THE TELLERS COMMITTEE

Ballots received from the Secretary-Treasurer were counted by the Tellers Committee in the manner prescribed by the by-laws to preserve the secrecy of the ballots. Kenneth R. Tefertiller received a majority of the votes cast for President-Elect. Chester Baker and Kenneth R. Farrell received a majority of the votes cast for Director in their respective categories.

Respectfully submitted,
A. FRANK BORDEAUX, JR. AND
BRUCE R. BEATTIE

REPORT OF THE VISITING LECTURER COMMITTEE

The program is limited to those universities offering an undergraduate or master's degree but not a Ph.D. degree. Association funds are not available for

the program and the schools have few funds available to support the program. Attempts are made to match the institution's desire for a particular individual to give a lecture and the availability of that person to travel to the college or university.

Eight institutions indicated a desire for visiting lecturers. When requests for specific individuals were made, the committee contacted the individuals. Our records show that the following colleges and universities were provided with lecturers:

<i>Colleges and Universities</i>	<i>Lecturers</i>
Brigham Young University	C. E. French, Purdue
Western Illinois University	Ronald Aines, Resources for the Future, Inc.
Southern Illinois University	Marion Clawson, Resources for the Future, Inc.
North Carolina Agricultural and Technical State University	R. J. Hildreth, Farm Foundation
Wisconsin State University (Platteville)	Pat Luby, Oscar Mayer Co.

Assuming the Board wishes to continue the program, the committee requests the Board and members of the Association to contact eligible colleges and universities to make requests for visiting lecturers under the auspices of the program. The committee will recontact the institutions requesting lecturers as in past years and will set in motion the processes of the program for next year. The committee would be very happy to receive additional requests.

The Association owes a deep debt of gratitude to those lecturers who went to considerable personal difficulty to give lectures.

Respectfully submitted,
R. J. HILDRETH, *Chairman*

REPORT OF THE AAEA REPRESENTATIVE TO THE NATIONAL RESEARCH COUNCIL

NRC is being reorganized by the National Academy of Science, of which it is the principal working arm. The former divisional structure will give way to two classes of organizational units. The first consists of three *assemblies* relating to the physical sciences, the life sciences, and the social and behavioral sciences. The assemblies will consist of society representatives and other scientific and professional members from several sources. Though the assemblies will be empowered to undertake disciplinary studies, their main function apparently will be to provide a means of receiving ideas from and reflecting the opinions of the general scientific community. *Commissions and boards* will be mission-oriented, will have memberships appropriate to their purposes, and apparently will be the principal mechanism for plan-

ning and conducting studies. NRC seems likely to remain a vast conglomerate of variously designated committees, all tightly controlled by policies established by NAS.

NRC has been casting about for an effective means of bringing the views of scientific societies on nationally significant problems to its attention. In practice, however, society representatives have had no significant role in NRC in the past, and the assemblies may not be much more effective in the future. The other half of the difficulty in achieving the objective, of course, is formulating within the societies specific ideas for NRC's consideration. Much of NRC's work in the past—as was intended—has been in response to requests from government agencies and other nonscientific groups. To the extent that independent scientists have influenced problem definition, they appear to have done it by working directly as individuals or small groups with the boards, committees, and staff of NRC.

G. E. BRANDOW

REPORT OF THE AAEA REPRESENTATIVE TO THE NATIONAL BUREAU OF ECONOMIC RESEARCH

The National Bureau of Economic Research commemorated its 50th anniversary with a series of colloquia designed to explore the effects of pending and anticipated policy issues on future research priorities within areas of concern among bureau members. The papers and discussions presented have been published in 1972 in seven volumes under the general title, *Economic Research: Retrospect and Prospect*. Titles of the seven volumes are: *The Business Cycle Today*, *Finance and Capital Markets*, *Policy Issues and Research Opportunities in Industrial Organization*, *Public Expenditures and Taxation*, *Economic Growth*, *Human Resources*, and *Quantitative Economic Research: Trends and Problems*. Each colloquium was directed toward substantive research questions and development of hypotheses in economics research assumed to be of priority interest. Many of the suggestions are or will be of interest to agricultural economists especially in areas of economic growth, capital markets, and human resources.

The general research program of the bureau as reported in the 51st Annual Report is organized in 85 projects in eight general areas: (1) Economic and social performance, including productivity, employment and price levels, national income, consumption and capital formation, and public finance; (2) Urban and regional economics; (3) Human resources and social institutions, including education and human capital, population and fertility, law and economics; (4) Business cycles, money, determinants of investment, and forecasting; (5) Financial institutions and processes; (6) Industrial organization, including health and medical care; (7) International economic relations; (8) Measurement methods, including

econometric and statistical techniques and electronic computer services.

In regard to computer services, the bureau has undertaken a major project to improve the way computers are used in research. With the support of the National Science Foundation, a Center for Research in Computational Techniques for Economics and Management Science has been established in Cambridge, Massachusetts. In a somewhat related area a new study series, Conference on Econometrics and Mathematical Economics, got underway in 1971 with establishment of seven continuing seminars. This program operates through the participation of leading scholars in a series of small specialized seminars at major research centers and universities under direction of resident experts. Topics of current seminars include, for example, Evaluation of Econometric Models, Decentralized Economic Planning and Programming, Distributed Lags and Time-Series Analysis. Plans for 1972 include the development of four additional seminars and occasional meetings of all conference members to review past work and discuss new developments in theory or methodology.

Thirteen National Bureau publications were issued in 1971—one volume of conference proceedings and 12 staff reports comprised of 7 books, 4 occasional papers, and a technical paper.

HAROLD G. HALCROW

REPORT OF LIAISON REPRESENTATIVE TO AMERICAN SOCIETY OF AGRONOMY

The AAEA representative to the American Society of Agronomy is on the mailing list to receive copies of all minutes of business and professional meetings of various committees of the society. The American Society of Agronomy is currently in the process of revising its bylaws and reexamining its subject matter divisions to serve today's needs and has requested information about the operations and procedures followed by our society. With the assistance of John Redman, I am providing them with the information requested. Tentative plans are for the development of a symposium on the broad topic of agronomic systems. The American Society of Agronomy recognizes the need of working with economists in putting together all the parts researched on into a total system.

C. R. HOGLUND

REPORT ON THE COUNCIL FOR AGRICULTURAL SCIENCE AND TECHNOLOGY

Efforts to form CAST began about two years ago. The purpose is to bring knowledge from the agricultural sciences to bear upon national policy in such areas as environmental protection and food safety by maintaining an office in Washington to keep agricultural scientists informed and to make appropriate arrangements to bring their views before Congressional and administrative bodies. The governing members

of the council will be agricultural science societies, and it will have supporting members from industry.

Nine societies have committed themselves to becoming members, and more are considering it. There is a good possibility that CAST will occupy space and work closely with the American Institute of Biological Sciences, with which numerous agricultural science societies have been affiliated in the past. CAST hopes to open a Washington office in January 1973 with a staff of two professionals and a secretary. Application for tax-exempt status has been filed with IRS. The circumstances under which the AAEA Board decided in 1971 not to become a member of CAST remain about as they were.

G. E. BRANDOW

MINUTES OF THE EXECUTIVE BOARD MEETING

New Orleans, Louisiana, December 27, 1971

The meeting was called to order by President Vernon W. Ruttan at 8:10 p.m.

Present:

Voting members: Ruttan, Hillman, Castle, Hildreth, Tweeten, Wallace, Day, McKee (Sundquist absent)

Members ex officio: Redman, Plaunt, Tefertiller, Gardner, Langham (representing Polopolus)

Guests: Wills, Upchurch, Senn

1. Ruttan reported for Wiegman, chairman of the local arrangements.
2. Redman presented the minutes of the meeting of the Executive Board held at Carbondale, Illinois, on August 14-15, 1971. Hildreth moved to adopt the minutes as previously distributed. Seconded. Passed.
3. Wills presented the final report on the arrangements for the 1971 meeting held at Carbondale, Illinois. Two principal recommendations were made for future meetings. First, the preprinting of the seminar papers be eliminated because of the number of late registrations, questionable value, not prepared correctly and involved extra typing and expense. Second, the women and children programs be eliminated because of the work and difficulty in planning appropriate programs. Wills also reported that a \$5,964.78 balance resulted from the Annual Meeting and because of certain expenses assumed by the Southern Illinois University suggested that he remit \$3,000 to AAEA and \$2,964.78 be retained by SIU. Wills commented further on some traits and characteristics of some attending the Annual Meetings.
4. Hillman moved to accept the report and the balance be split as suggested. Seconded. Passed.
5. Hildreth raised a question on policy of assuming the loss or surplus as result of Annual Meetings. The consensus was that it should be *ad hoc*.
6. Concerning the women and children programs, it was agreed not much should be done about setting policy for 1972 and 1973 meetings. Castle moved that beginning with the Summer 1974 Annual Meeting, the women and children programs be limited to a hospitality room, a listing of things families may do on their own, and a list of baby sitters; and that during the 1972 and 1973 meetings the host institution be given complete freedom to minimize the activities and effort devoted to these programs. Seconded. Passed.
7. On the issue of preprinting papers, a discussion was centered on the potential value. The consensus was that even a small percentage reading the papers beforehand would increase the level of discussion. The need was to find a simple, low-cost method of reproduction. Castle, Tefertiller, and Redman were appointed to study the issue and report back to the Board.
8. The August 1971 action of the Board authorized the President to appoint a committee to review the AAEA committee structure and activities with the view of being more efficient. Castle commented that he was appalled with the scope of the AAEA activities but felt that the Board was charged with this responsibility. Hildreth mentioned that a number of activities was set up purposely to hold segments together and that this raised three concerns—a diversity of activities, the ways committees are appointed, and cost to the AAEA. Hillman moved that the President-Elect be instructed to prepare his committee structure prior to becoming President. Seconded. Passed.
9. A discussion was held on the role of agricultural economics in the Council of Agricultural Science and Technology with a suggestion that any information obtained be referred to Wallace. No action was taken.
10. Ruttan explained how the U. S. Council of IEEA is elected and that the AAEA serves as a communications medium. Each three years the AAEA has made a grant to pay for travel. Breimyer has suggested that the U. S. Council be made part of the AAEA. Hillman moved that the issue be tabled. Seconded. Passed.
11. Langham reported on editorial activities, indicating that the next issue was on schedule and that a study of page charges was being made. Hillman moved that editorial support be increased to \$15,000 plus postage of \$600, effective January 1, 1972. Seconded. Passed.
12. Redman reported on a study being made on possibilities of reducing the cost of publication of the *Journal*.

Meeting recessed at 11:30 p.m. and reconvened on Wednesday, December 29, 1971, at 8:30 a.m.

Present:

Voting members: Ruttan, Tweeten, McKee, Castle, Day, Hildreth, Wallace (Hillman and Sundquist were absent)

Members ex officio: Redman, Langham, Plaunt, Tefertiller, Gardner

Guests: Baker, Pearson, Martin, Thorbecke

13. Thorbecke reported on the activities of the International Committee which included the Economic Institute at Boulder and a possible session at the summer meeting.
14. McKee reported for the joint ASA-AAEA Committee on Agricultural Statistics.
15. Hildreth reported for the Economic Statistics Committee, pointing out the changing uses and needs for revisions of statistical series.
16. Martin reported for the Postwar Literature Review Committee.
17. Baker reported for the Awards Study Committee which was asked to evaluate the AAEA Awards Program.

Recessed at 10:20 a.m. and reconvened at 1:00 p.m.

Present:

Voting members: Ruttan, Tweeten, Hildreth, Wallace, Day, Castle (McKee, Hillman, and Sundquist absent)

Member ex officio: Redman

Guest: Pearson

18. Day reported for the AAEA Bibliography Committee, indicating that approximately 1,000 additional copies of Volume I of the *American Bibliography of Agricultural Economics* were printed and to be sent to the foreign libraries with AID paying for the cost.
Day moved that ERS allotment of the ABAE be increased from 40 to 50 copies. Seconded. Passed.
19. Redman reported on the need to maintain a more accurate and time-saving addressing system. The printer has suggested that the address plates be transferred to the Secretary-Treasurer's office.
Tweeten moved that the Secretary-Treasurer be authorized to purchase suitable equipment after a careful study is made of the needs. Seconded. Passed.
20. Redman reported that Ohio State University has invited the AAEA to hold the 1975 Annual Meeting on its campus.
Hildreth moved that the invitation be accepted. Seconded. Passed.
21. Redman reported that the American Economics Association is changing some future meeting dates to early fall which may affect the future of the Winter Meeting of the AAEA.
22. Redman raised the question of the student rate being less than one-half of the regular rate which

may not conform with the postal regulations. No action was taken but the question is to be studied further.

23. A suggestion was made that Redman prepare alternative budgets reflecting the costs of various activities and issues and send these to the President and President-elect prior to the Summer Meeting.
24. It was suggested that in the future before any decision is made to expend money a report on budgetary situation be obtained.
25. Hildreth reported on a request from a member that an essay contest be conducted. The consensus was that the proposal was in line with professional interest and the possibility should be explored.
26. Castle reported for the *ad hoc* committee on the problem of preprinting the papers for the Annual Meeting. The main points were (1) it is difficult to decide if the program warrants the preprinting, (2) printing be the responsibility of the host institution with the constraints of the available facilities, (3) papers be reproduced as received, not edited, and the President set the rules for submission, (4) deadline be set by the host institution and they may be either mailed or placed in registration packages.
27. Day moved that the University of Florida negotiate with the Flagler Inn to reserve and guarantee 150 rooms for the 1972 Annual Meeting. Seconded. Passed.

Meeting adjourned at 4:30 p.m.

Respectfully submitted,

JOHN C. REDMAN, *Secretary-Treasurer*

MINUTES OF THE EXECUTIVE BOARD MEETING

Gainesville, Florida, August 19-23, 1972

The meeting was called to order by President Vernon Ruttan at 9:00 a.m., August 19, 1972.

Present:

Voting members: Ruttan, Castle, Hildreth, Tweeten, Sundquist, Wallace, Day

Members ex officio: Redman, Polopolus, Gamble, Brown, McConnen, Plaxico

Guests: Pearson, Tefertiller, Baker, Langham

1. Minutes of the Executive Board meeting at New Orleans December 27, 1971, were approved as distributed.
2. Polopolus welcomed the Executive Board to the University of Florida campus.
3. Pearson and Tefertiller reported for the Local Arrangements Committee, indicating that about 950 members and a total of 2,000 persons had registered.
4. Tefertiller reported on an effort of a firm making a film documentary on rural-urban America.

Hildreth and Wallace were appointed to work with the representative, particularly as related to community development.

5. Redman reported for the Tellers Committee and Tefertiller was elected the President-Elect and that Baker and Farrell were elected Directors. Castle moved the acceptance. Seconded. Passed.
6. Polopolus reported as Editor, discussing policy to include more coverage in the *Journal*, the acceptance rate which is declining, the page charge report, and several other editorially-related problems. The Editor was commended for an excellent report.
7. Day reported for the Advisory Committee for the *American Bibliography of Agricultural Economics*. Expressing the need to process a backlog of items, Day moved that \$600 be allocated for this purpose. Seconded. Passed. After a discussion of the problems associated with the number of issues per year, Day moved that the number of issues be reduced from six to four times a year, effective for 1973. Seconded. Passed. The committee recommended that the cost of the ABAE be included in the regular dues. No action was taken.
8. Redman reported for the Handbook-Directory Committee.
9. Castle reported on preliminary plans for future meetings in Toronto.
10. Redman reported on locations of future meetings of AAEA. Wallace moved that in 1977 the AAEA hold the Annual Meeting at a commercial facility and that a committee be appointed to select the appropriate site. Seconded. Passed. Wallace, Farrell, and Redman as chairman were appointed. It was suggested that the 1978 time be coordinated with the change made by the American Economic Association.
11. Redman distributed the Secretary-Treasurer's Report and Investment Committee Report for 1971, both to be presented at the Business Session.
12. As requested in an Executive Board motion in 1970, Redman reported that the current procedure of balloting the foreign members appears to be satisfactory.
13. Redman reported 59,500 copies of the AAEA brochure had been ordered.
14. Redman reported on the apparent need for the AAEA to obtain general liability insurance for the officers who travel in connection with official business. Redman was instructed to check with a legal authority to determine the need and report back at the next meeting.
15. Baker reported for the Awards Committees, announcing that 22 awards had been made. Also, Baker reported on an evaluation of the Awards Program, itemizing several areas studied. After considerable discussion, Tweeten moved that all cash awards be eliminated except for the awards

for the Master's and Ph.D. theses and that each of these carry a cash award of \$100. Seconded. Passed.

16. Ruttan read the report of the *Ad Hoc* Committee on Sustaining Membership Classification. It was recommended that the present classification of "Sustaining Member" be designated as "Institutional Member" and the bylaws be amended accordingly. Hildreth moved that the bylaws be amended to read as follows:

Article II, Second 2d. Each institutional member may designate up to three (3) representatives who shall be regarded as, and enjoy the same privileges of regular members. Any person, firm, corporation, association, group or partnership may become an institutional member upon payment of such sum as may be fixed from time-to-time by resolution of the Executive Board.

Article III, Section 1d. Institutional membership—\$100.

Seconded. Tweeten moved that the motion be amended to limit each Institutional Member to one vote. Seconded. Passed. Original motion as amended. Passed. Ruttan moved that the new committee be appropriately named and that the Secretary-Treasurer work out the procedures with the chairman for billing Institutional Members. Seconded. Passed.

17. Sundquist moved that the AAEA express its appreciation to the Farm Foundation for its continued support and interest in the Fellows of the American Agricultural Economics Association. Seconded. Passed.
18. Hildreth reported on some aspects of the Professional Activities Committee's work.
19. Gamble reported for the Northeast Agricultural Economics Council, raising the question that the NAEC representative be given a vote on the Executive Board of the AAEA. No action was taken.
20. Plaxico reported for the Southern Agricultural Economics Association, noting that about 1,000 members are necessary for a viable organization and suggested that an application form be included in each issue of the AJAE. Day moved that the AJAE run an exchange ad with the regional associations, including Canada, in a manner acceptable to the Editor. Seconded. Passed.

Recessed at 5:45 p.m.

Reconvened at 9:15 a.m., August 20.

Present:

Voting members: Ruttan, Castle, Tweeten, Sundquist, Wallace, Day, Hildreth
 Members ex officio: Redman, Polopolus, Plaxico, Brown, McConnen, Gamble
 Guests: Baker, Nielson, Sjo, Helmberger, Tefertiller, Wadsworth, Breimyer, Weisblat

21. Wallace reported on additional aspects of the Professional Activities Committee.
 22. Nielson reported for the Education Committee, reporting on plans for the workshop, including the financial aspects of the workshop and publication of the papers.
 23. Sjo reported for the Student Affairs Committee, recommending that a special committee be named to evaluate the entire student affairs program. Castle moved that a special committee be appointed to evaluate the student affairs activities as well as potential programs and the role of undergraduate professional education and that this committee include a representative from the Professional Activities Committee. Seconded. Passed.
 24. Tweeten moved the approval of the student affairs budget which allowed \$600 for awards, \$300 for judges, \$150 for newsletters, \$70 for plaques, keys, etc., and \$20 for printing and miscellaneous, or a total of \$1,140. Seconded. Passed.
 25. Wadsworth reported for the Extension Affairs Committee.
 26. Schertz reported for the International Committee, pointing out several areas and possible activities in which agricultural economists should be concerned.
 27. Breimyer reported for the U. S. Council of International Association of Agricultural Economists. The next meeting will be in Sao Paulo, Brazil, August 19-30, 1973. Tweeten moved that the AAEA appropriate \$5,000 from its reserves to provide a fellowship for partial financing of travel to the 1973 meeting of the International Association of Agricultural Economists in Sao Paulo, Brazil. The fellows shall be selected from various fields and shall be 35 years old or less. They shall be selected from the membership of the AAEA by representatives of the AAEA in cooperation with the U. S. Council of International Association of Agricultural Economists. Fellowships shall not be in excess of air fare from the U. S. to Sao Paulo. The appropriation shall be matched by the Fund for the International Conference of Agricultural Economists. Seconded. Passed.
 28. Brown reported for the Canadian Agricultural Economics Society. The CAES will hold a joint meeting with AAEA in Edmonton August 8-11, 1973.
 29. Sundquist moved that AAEA advance up to \$2,000 to the University of Alberta for the 1973 meeting. Seconded. Passed.
 30. Wallace reported for an *ad hoc* committee on the role of the *Journal* and its problems. The committee noted that the purpose of the AAEA journal is, broadly, to present research findings, professional experiences, reviews, observations, and news pertinent to those in the profession. Rising printing costs, increased number and quality of *Journal* submissions, and a diverse membership call for a review of the role and operational "format" (article length, content, Proceedings papers/discussions, extension, teaching, business, and other submissions, association business reporting; i.e., the entire scope, content, authors, readers, and users of the present *Journal*). Wallace moved that a committee knowledgeable about the *Journal* be appointed by the President to make such a review for the Executive Board of the AAEA in the next year. Seconded. Passed.
 31. Bonnen reported for the Committee on Statistics and the ASA-AAEA Joint Advisory Committee on Agricultural Statistics.
 32. Martin reported for the AAEA Literature Review Committee.
 33. Ruttan reported for Brandow on the Council for Agricultural Science and Technology.
 34. Mather reported for the Employment Committee. Day moved that the AAEA support and express its intentions to cooperate with the U. S. Department of Labor in a proposal to develop an effective employment service for professionals in social sciences, and that the AAEA authorize the President, in consultation with Hathaway, to enter into agreement with the U. S. Department of Labor to implement the proposal. Any funds to be expended by the AAEA will be subject to authorization by the Executive Board. Seconded. Passed.
 35. Tweeten moved that the travel expense be paid for the small college representative on the Employment Committee. Seconded. Passed.
 36. Ruttan reported for the Industry Committee.
 37. Hildreth discussed the principle involved in non-district payment for services for the AAEA in the future.
 38. Tweeten moved for approval of the budget as adjusted. Seconded. Passed.
- Adjourned at 3:45 p.m.
- The meeting was called to order by President Castle at 1:05 p.m., August 23, 1972.
- Present:
- Voting members: Castle, Ruttan, Tefertiller, Sundquist, McKee, Baker, Farrell, Day
- Members ex officio: Redman, Polopolus, Brown
- Guest: Manning
1. Ruttan, noting the discussion by Hildreth, moved that the Executive Board of the Association adopt the principle that any payment for part-time services of officers or other members of the Association employed elsewhere should be made to the employer rather than to the individual. This would apply where the rendering of such services requires a significant reduction of the individual's service to his employer. Adopted.

tion of this principle does not affect existing relationships for services and the principle would become operational on the development of new relationships. Seconded. Passed.

2. Manning reported on plans for the 1973 Annual Meeting, scheduled jointly with the Canadian Agricultural Economics Society and the Western Agricultural Economics Association.
3. Baker requested approval of the meeting of the Awards Committees. Ruttan moved to authorize the Awards Committees to meet to complete the awards evaluation and that the President authorize travel expenses in those situations where expenses cannot be met by the home institution. Seconded. Passed.
4. Polopolus expressed concern regarding the cost of printing papers for the Review of Literature.
5. Castle presented a preliminary format for the 1973 AAEA program and asked for comments and suggestions.

Adjourned at 3:30 p.m.

Respectfully submitted,

JOHN C. REDMAN, *Secretary-Treasurer*

MINUTES OF THE ANNUAL BUSINESS MEETING Gainesville, Florida, August 23, 1972

The meeting was called to order by President Ruttan at 8:30 a.m.

1. President Ruttan presented for approval the minutes of the Annual Business Meeting held in Carbondale, Illinois, August 18, 1971, as published in the proceedings issue of the *AJAE*. Breimyer moved approval. Seconded. Passed.
2. Redman presented the Secretary-Treasurer's Report for the fiscal year January 1 through December 31, 1971.
3. Redman presented the Investment Committee Report for the fiscal year January 1 through December 31, 1971.
4. Redman presented the report for the Audit Committee for the fiscal year January 1 through December 31, 1971.
5. Polopolus reported as Editor of the *AJAE*.
6. Ruttan summarized the actions of the Executive Board. These include: (1) changed the frequency of publication of *American Bibliography of Agricultural Economics* from six issues to four per year, effective with the 1973 volume; (2) changed the name of the Sustaining Member

to Institutional Member and amended the by-laws accordingly; (3) the Handbook-Directory is in press and should be in the mail soon; (4) decided to hold the 1977 Annual Meeting at a commercial facility; (5) eliminated all cash awards in the Awards Program, except for the Ph.D. and Master's theses awards which were set at \$100 each; (6) received a progress report in December; (7) again authorized \$5,000 for support of travel to the 1973 IAEA meeting for the younger staff; (8) reported on Employment Services study; (9) announced that an educational workshop will follow the Annual Meeting on the University of Florida campus.

7. Redman presented a budget for 1973 for consideration. Breimyer moved that the budget be approved. Seconded. Passed.
8. Hildreth presented a resolution thanking the University of Florida for hosting the meeting, with copies of the resolution to be sent to appropriate personnel. Seconded. Passed.
9. With no further business, President Ruttan thanked the membership for the privilege of serving. He expressed a disappointment in not having a name change of the Association during his administration reflecting applied economics and cited several reasons to support his viewpoint. He then turned the meeting over to President Castle. Castle announced that the name change would be examined carefully; the meeting dates and nature of the program for the Winter Meeting; the Nominating Committee for officers for next year; and suggested that nominations for Fellows be in the hands of the Secretary-Treasurer before the Winter Meeting.

The meeting was adjourned at 10:00 a.m.

Respectfully submitted,

JOHN C. REDMAN, *Secretary-Treasurer*

SAEA TO MEET

The Southern Agricultural Economics Association will meet in Atlanta Feb. 4-7, 1973. Papers will be presented in the areas of Commercial Agriculture, Rural Development and Planning, and Emerging Issues in Agricultural Economics. Detailed information is available from SAEA President James S. Plaxico, Oklahoma State University.

INDEX TO VOLUME 54

1972

SUBJECTS

Agricultural Data

- Analysis of the Accuracy of USDA Crop Forecasts, 639
- Future Census Data for Agriculture: Comment, 360
- Future Census Data for Agriculture: Reply, 363
- Our Obsolete Data Systems: New Directions and Opportunities, 867 (Discussions, 875, 878)

Agricultural Economics, General

- Economics and the Quality of Life, 723
- Associations (of)*
 - Allocation of Colleges and Economists, 934
 - Has the AAEA Become "Awards Happy"? A Comment, 139
 - Has the AAEA Become "Awards Happy"? A Reply, 140
- Locational Distribution of AAEA Membership and *Journal* Contribution, 145
- Ph.D. Dissertation Awards: Does the Best Always Win?—Comment, 141
- Tradition and Protectionism—The AAEA and Its *Journal*: Comment, 520
- Tradition and Protectionism—The AAEA and Its *Journal*: Reply, 521

Extension

- Clientele for Continuing Education in the 1970's, 910 (Discussions, 928, 930)
- Delivery Systems for Continuing Education, 916 (Discussions, 928, 930)
- Research Support for Continuing Education, 922 (Discussions, 928, 930)

Profession (of)

- Allocation of Colleges and Economists, 934
- Evaluation of Departments of Agricultural Economics (On the): Comment, 532
- Evaluation of Departments of Agricultural Economics (On the): Reply, 534
- Needed: More Efficient Use of Computer Resources, 693
- Present Status of Quantitative Techniques in Undergraduate Agricultural Economics Programs, 102
- Quantitative Training of Undergraduates: Comment, 531
- Quantitative Training of Undergraduates: Reply, 532

Research

- Agricultural Marketing Research for Less-Developed Areas, 666
- Needed: More Efficient Use of Computer Resources, 693
- Our Obsolete Data Systems: New Directions and Opportunities, 867 (Discussions, 875, 878)
- Research Support for Continuing Education, 922 (Discussions, 928, 930)

Teaching

- Evaluation of Departments of Agricultural Economics (On the): Comment, 532
- Evaluation of Departments of Agricultural Economics (On the): Reply, 534

Quantitative Training of Undergraduates: Comment, 531

Quantitative Training of Undergraduates: Reply, 532

Agricultural Finance, Capital, Credit

- Demand for Financial Assets in the Farm Sector: A Portfolio Balance Approach, 163
- Discrimination in the Markets for Farm Capital? Comment, 369
- Discrimination in the Markets for Farm Capital? Reply, 371
- Is There Disinvestment in the Farming Sector?, 275
- Strategies for the Creation and Transfer of the Farm Estate, 461

Agricultural Income

Personal and Factor Income Distribution

- Agricultural Technology and the Distribution of Welfare Gains, 801 (Discussions, 815, 817)
- Technical Change and the Distribution of Income in Rural Areas, 326 (Discussions, 355, 357)

Rural Poverty

- Income Maintenance Programs in the 1960's: A Survey, 342 (Discussions, 355, 357)
- Technical Change and the Distribution of Income in Rural Areas, 326 (Discussions, 355, 357)

Agricultural Labor; Rural Manpower

American Agriculture and the Prophecy of Increasing Misery, 570

Labor Markets

- Impact of Minimum Wages Upon the Level and Composition of Agricultural Employment, 477
- Minimum Wages and the Farm Labor Market, 473

Policy

- Impact of Minimum Wages Upon the Level and Composition of Agricultural Employment, 477
- Minimum Wages and the Farm Labor Market, 473

Agricultural Products: Demand, Supply, Prices

- Combining Statistical Techniques with Economic Theory for Commodity Forecasting, 784
- Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches—Rejoinder, 528
- Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches—A Further Reply, 530

Dairy Products

- Consumer Attitudes and Their Impact on Fluid Milk Demand in Hawaii: A Component-Regression Analysis Approach, 671
- Polynomial Lag Formulation of Milk Production Response (A), 77
- Price Alignment and Movements of Class I Milk Between Markets, 496

Field Crops

- Analysis of the Accuracy of USDA Crop Forecasts, 639
- Distributed Lag Models of Cotton Acreage Response: A Further Result, 108

- Inter-Fiber Competition and the Future of the United States Cotton Industry, 209
- Market-Share Approach to the Foreign Demand for U. S. Cotton (A): Comment, 375
- Market-Share Approach to the Foreign Demand for U. S. Cotton (A): Reply, 376
- Supply Analysis for Corn in the United States: The Impact of Changing Government Programs, 184
- Food Items**
- Estimation of Demand Parameters Under Consumer Budgeting: An Application to Argentina, 422
- Fruits and Vegetables**
- Harmonic Analysis of Seasonal Data: Some Important Properties, 646
- Livestock and Livestock Products**
- Investment Behavior and the Supply Response of the Cattle Industry in Argentina (The), 976
- Open Econometric Model of the Canadian Beef Cattle Sector (An), 84
- Quarterly Models to Predict Cash Prices of Pork Bellies, 603
- Trend Models of Feeder, Slaughter, and Wholesale Beef Cattle Prices, 507
- Marine Products**
- Econometric Analysis of Shrimp Ex-Vessel Prices, 1950-1968 (An), 431
- Other**
- Converting National Supply and Demand Equations to a Common Currency for Internationally Traded Commodities, 538
- Econometric Analysis of the Demand for Textile Fibers (An), 238
- Public Pressures and Values, Federal Policy Changes, and Future Timber Supply, 881 (Discussions, 887, 889, 890)
- Poultry and Eggs**
- Demand, Supply, and Price Relationships for the Broiler Sector, With Emphasis on the Jack-Knife Method, 245
- Cooperatives and Cooperation**
- Total Marketing System for U. S. Dairy Cooperatives (A), 271
- Economic Development, Growth and Planning**
- Foreign**
- Agricultural Marketing Research for Less-Developed Areas, 666
- Green Revolution (The): A Reply to Professors Ruttan and Mellor, 366
- Green Revolution (The): A Reply to Professors Ruttan and Mellor: A Further Reply, 368
- Project Selection and Macroeconomic Objectives: A Methodology Applied to Peruvian Irrigation Projects, 32
- Projections of Effects of Modern Inputs on Agricultural Income and Employment in a Community Development Block, Uttar Pradesh, India, 452
- Rice Policy in Japan's Economic Development, 19
- General**
- Shift-Share Analysis as a Technique in Rural Development Research, 267
- United States**
- General Model for Evaluating Agricultural Flood Plains (A), 92
- Socioeconomic Behavior of Cattle Ranchers, with Implications for Rural Community Development in the West, 217
- Environmental Economics**
- General**
- Agricultural Productivity, Technology, and Environmental Quality, 749 (Discussions, 757, 760, 761)
- Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment, 893 (Discussions, 901, 903, 905)
- Defense of a Steady-State Economy (In), 945
- Economics and the Quality of Life, 723
- Effects of Zero Population Growth on the Spatial Distribution of Economic Activity (The), 964
- Implications of Zero Growth for Agricultural Commodity Demand (The), 955
- Market Solutions to Externality Problems: Theory and Practice, 175
- Note on Uncertainty and Nonmarket Cost (A), 652
- Pollution**
- Economic and Policy Implications of Pollution From Agricultural Chemicals: Comment, 534
- Economic and Policy Implications of Pollution From Agricultural Chemicals: Reply, 536
- Impact of Air Pollution Abatement Activities of Coal-Burning Electric Power Generating Plants on the Fertilizer Industry (The), 977
- Theory of the Firm and The Management of Residuals, 315 (Discussion, 322)
- Food and Consumer Economics**
- Ciente for Continuing Education in the 1970's, 910 (Discussions, 928, 930)
- Consumer Attitudes and Their Impact on Fluid Milk Demand in Hawaii: A Component-Regression Analysis Approach, 671
- Estimation of Demand Parameters Under Consumer Budgeting: An Application to Argentina, 422
- Michigan Food Stamp Program: A Partial Analysis of Performance, 51
- Taste, Technology and the Government: The Case of Tobacco, 976
- General Economics**
- Systems**
- Defense of a Steady-State Economy (In), 945
- Effects of Zero Population Growth on the Spatial Distribution of Economic Activity (The), 964
- Implications of Zero Growth for Agricultural Commodity Demand (The), 955
- Theory—Micro**
- Generalized Power Production Function (The), 234
- Process Analysis and the Neoclassical Theory of Production, 279 (Discussion, 303)
- Profit, Supply, and Factor Demand Functions, 11
- Welfare**
- Agricultural Technology and the Distribution of Welfare Gains, 801 (Discussions, 815, 817)
- Market Solutions to Externality Problems: Theory and Practice, 175
- Note on Uncertainty and Nonmarket Cost (A), 652
- Human Resource Development**
- Southern Tradition and Regional Progress: A Perspective from the 1970's, 736 (Discussions, 745, 747)

Demographic Economics

- Implications of Zero Growth for Agricultural Commodity Demand (The), 955
- Simulation Study of Population, Education, and Income Growth in Uganda (A): Comment, 524

Education

- Allocation of Colleges and Economists, 934
- Analytical Approach to the Consolidation of Counties in North and West Florida Based on Educational Efficiency Criteria (An), 980
- Causes and Consequences of Higher Education: Models of the Status Attainment Process, 851 (Discussions, 862, 863)
- Clientele for Continuing Education in the 1970's, 910 (Discussions, 928, 930)
- Delivery Systems for Continuing Education, 916 (Discussions, 928, 930)
- Research Support for Continuing Education, 922 (Discussions, 928, 930)

Human Capital

- Increasing Economic Value of Human Time (The), 843 (Discussions, 862, 863)

Welfare Programs

- Analysis of the Market for Food Stamps (An), 305
- Analysis of the Market for Food Stamps: Correction and Extension (An), 689
- Michigan Food Stamp Program: A Partial Analysis of Performance, 51
- Welfare Analysis of Poverty Programs, 809 (Discussions, 815, 817)

Institutions

- Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment, 893 (Discussions, 901, 903, 905)
- Economics and the Quality of Life, 723
- Evaluation of Local Nonproperty Taxes For Rural and Urban Areas in Kansas, 635
- Legal and Economic Rights of Holders of Government Allotments, 622
- Sacred Cows, 526
- Southern Tradition and Regional Progress: A Perspective from the 1970's, 736 (Discussions, 745, 747)

Marketing and Location

- Agricultural Marketing Research for Less-Developed Areas, 666

Competitive Position

- Inter-Fiber Competition and the Future of the United States Cotton Industry, 209

Distribution

- Total Marketing System for U. S. Dairy Cooperatives (A), 271

Efficiency

- Allocation of Random Supply of Tomatoes of Varied Quality Produced in Different Areas Among Plants Producing Multiple Product Lines, 790
- Assembly and Distribution System Management: An Application of Lockset, 661
- Price Alignment and Movements of Class I Milk Between Markets, 496

Futures Markets

- Analysis of Potential Hedging Criteria for Live Hogs Using Seasonal Indices, 972

- Economic Implications of Nonpar Delivery Points for the Live Cattle Futures Contract, 111

Location

- Allocation of Random Supply of Tomatoes of Varied Quality Produced in Different Areas Among Plants Producing Multiple Product Lines, 790
- Concave Programming Applied to Rice Mill Location, 126
- Low-Cost Spatial Equilibrium Solution Procedure (A), 373

Natural Resource Economics**Forests**

- Public Pressures and Values, Federal Policy Changes, and Future Timber Supply, 881 (Discussions, 887, 889, 890)

General

- Changed Distribution of Income Vs. Redistribution in Public Project Evaluation: Comment, 135
- Changed Distribution of Income Vs. Redistribution in Public Project Evaluation: A Reply, 137

Land Development and Land Use

- Dynamic Economic Model of Pasture and Range Investments (A): Comment, 131
- Dynamic Economic Model of Pasture and Range Investments (A): Reply, 131
- General Model for Evaluating Agricultural Flood Plains (A), 92
- More Sophisticated Tools for Less Important Problems: The History of Range Improvement Research: A Comment, 132
- More Sophisticated Tools for Less Important Problems: The History of Range Improvement Research: Reply, 134
- Use Rates, Resource Flows, and Efficiency of Public Investment in Range Improvements, 611

Marine and Fisheries

- Econometric Analysis of Shrimp Ex-Vessel Prices, 1950-1968 (An), 431

Water Resources Development and Use

- Changed Distribution of Income Vs. Redistribution in Public Project Evaluation: Comment, 135
- Changed Distribution of Income Vs. Redistribution in Public Project Evaluation: A Reply, 137
- General Model for Evaluating Agricultural Flood Plains (A), 92
- Model for Managing Reservoir Water Releases (A), 411
- Project Selection and Macroeconomic Objectives: A Methodology Applied to Peruvian Irrigation Projects, 32
- Risk Programming: An Aid in Planning Reservoir-Irrigation Systems, 249

Production Economics and Management**Asset Replacement**

- Asset Replacement Principles, 60

Firm Growth

- Economic Analysis of Financial Growth Strategies for Large Pennsylvania Dairy Farms Under Competitive Labor Conditions, 979
- Sequential Programming Model of Growth and Capital Accumulation of a Farm Under Uncertainty (A), 441

General and Theoretical

- Allocative Efficiency, Traditional Agriculture, and Risk: Comment, 522

Allocative Efficiency, Traditional Agriculture, and Risk: Reply, 524
 Alternatives to the Neoclassical Theory of the Firm (NTF), 295 (Discussion, 303)
 Economics of Cropshare, Once Again: Comment, 686
 Economics of Cropshare, Once Again: Reply, 688
 Generalized Power Production Function (The), 234
 Process Analysis and the Neoclassical Theory of Production, 279 (Discussion, 303)
 Profit, Supply, and Factor Demand Functions, 11
 Reliability of Using the Mean Absolute Deviation to Derive Efficient E, V Farm Plans, 503
 Stepped Product Demand and Factor Supply Functions in Linear Programming Analyses, 116
 Theory of the Firm and The Management of Residuals, 315

Inputs

Asset Indivisibility and Investment Planning: An Application of Linear Programming, 255
 Asset Replacement Principles, 60
 Comparison of Annual Versus Average Optima For Fertilizer Experiments (A), 226

Organization and Management

Agricultural Productivity, Technology, and Environmental Quality, 749 (Discussions, 757, 760, 761)
 Allocation of Random Supply of Tomatoes of Varied Quality Produced in Different Areas Among Plants Producing Multiple Product Lines, 790
 Analysis of Potential Hedging Criteria for Live Hogs Using Seasonal Indices, 972
 Break-Even Analysis: A Practical Tool in Farm Management, 121
 Changing Federal Income Tax Rates and Optimum Farm Size, 490
 Dynamic Economic Model of Pasture and Range Investments (A): Comment, 131
 Dynamic Economic Model of Pasture and Range Investments (A): Reply, 131
 Economics of Cropshare, Once Again: Comment, 686
 Economics of Cropshare, Once Again: Reply, 688
 Generalized Constrained Games in Farm Planning, 591
 Investment Behavior and the Supply Response of the Cattle Industry in Argentina (The), 976
 More Sophisticated Tools for Less Important Problems: The History of Range Improvement Research: A Comment, 132
 More Sophisticated Tools for Less Important Problems: The History of Range Improvement Research: Reply, 134
 Optimal Levels of Fertilization Under Risk: Comment, 683
 Optimal Levels of Fertilization Under Risk: Reply, 685
 Optimal Sizes of Farms Under Varying Tenure Forms, Including Renting, Ownership, State, and Collective Structures: Comment, 142
 Optimal Sizes of Farms Under Varying Tenure Forms, Including Renting, Ownership, State, and Collective Structures: Reply, 143
 Practical Way to Select an Optimum Farm Plan Under Risk (A), 657
 Strategies for the Creation and Transfer of the Farm Estate, 461
 Tax Loss Agricultural Investments After Tax Reform, 627

Risk and Uncertainty

Allocative Efficiency, Traditional Agriculture, and Risk: Comment, 522
 Allocative Efficiency, Traditional Agriculture, and Risk: Reply, 524
 Economies of Size and the Spatial Distribution of Land in Farming Units, 654
 Generalized Constrained Games in Farm Planning, 591
 Optimal Levels of Fertilization Under Risk: Comment, 683
 Optimal Levels of Fertilization Under Risk: Reply, 685
 Optimal Levels of Fertilization Under Risk: The Potential for Corn and Wheat Fertilization Under Alternative Price Policies in Argentina, 1
 Practical Way to Select an Optimum Farm Plan under Risk (A), 657
 Separable Programming for Considering Risk in Farm Planning, 260
 Truncated Maximin Approach to Farm Planning Under Uncertainty with Discrete Probability Distributions (A), 192

Supply Response

Structure of Production of Multiple-Output Dairy Farms in the "Centro Santaferino" Region of Argentina: A Multivariate Analysis (The), 977

Public Policy and Programs

Domestic Agricultural Policy

Estimated Net Costs of P.L. 480 Food Aid with Three Alternative U. S. Farm Programs, 41
 Government Farm Programs and Commodity Interaction: A Simulation Analysis, 578
 Industrial Perspective on Agricultural Policy in the 1970's (An), 797
 Legal and Economic Rights of Holders of Government Allotments, 622

Foreign

Evaluation of Indian Fertilizer Projects: An Application of Consumer's and Producer's Surplus: Comment, 371
 External Credit Policy for Latin America: Comment, 364
 External Credit Policy for Latin America: Reply, 365
 Rice Policy in Japan's Economic Development, 19
 Social Rates of Return and Other Aspects of Agricultural Research: The Case of Cotton Research in São Paulo, Brazil, 557

General

Farmer Conservatism and the Incidence of Taxes, 485
 Policy Environment for U. S. Agricultural Trade (The) 821 (Discussions, 834, 836, 837, 840)
 Public Pressures and Values, Federal Policy Changes, and Future Timber Supply, 881 (Discussions, 887, 889, 890)
 Tax Loss Agricultural Investments After Tax Reform, 627

International Agricultural Policy

Michigan Food Stamp Program: A Partial Analysis of Performance, 51
 Modified Price, Production, and Income Impacts of Food Aid Under Market Differentiated Distribution, 201
 Structure of Production of Multiple-Output Dairy

Farms in the "Centro Santafecino" Region of Argentina: A Multivariate Analysis (The), 977

Programs

Analysis of the Accuracy of USDA Crop Forecasts, 639

Analysis of the Market for Food Stamps (An), 305 (Discussion, 322)

Analysis of the Market for Food Stamps (An): Correction and Extension, 689

Income Maintenance Programs in the 1960's: A Survey, 342 (Discussions, 355, 357)

Taste, Technology and the Government: The Case of Tobacco, 976

Regional Economics

Effects of Zero Population Growth on the Spatial Distribution of Economic Activity (The), 964

Community Development

Community Development in the 1970's, 764 (Discussions, 773, 776)

Regional Development

Social Accounting System and Simulation Model Projecting Economic Variables and Analyzing the Structure of the Oklahoma Economy (A), 978

Southern Tradition and Regional Progress: A Perspective from the 1970's, 736 (Discussions, 745, 747)

Rural Development

Investments in Agricultural Processing for Rural Development in Oklahoma, 513

Research Methodology

Econometric (application)

Demand, Supply, and Price Relationships for the Broiler Sector, With Emphasis on the Jack-Knife Method, 245

Distributed Lag Models of Cotton Acreage Response: A Further Result, 108

Open Econometric Model of the Canadian Beef Cattle Sector (An), 84

Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches—Rejoinder, 528

Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches—A Further Reply, 530

Quarterly Models to Predict Cash Prices of Pork Bellies, 603

Statistical Vs. Judgment and Audience Considerations in the Formulation and Use of Econometric Models, 779

General

Converting National Supply and Demand Equations to a Common Currency for Internationally Traded Commodities, 538

Institutional and Conceptual

Sacred Cows, 526

Operations Research

Asset Indivisibility and Investment Planning: An Application of Linear Programming, 255

Concave Programming Applied to Rice Mill Location, 126

Evaluation of Alternative Flexibility Restraint Procedures For Recursive Programming Models Used for Prediction, 68

Government Farm Programs and Commodity Interaction: A Simulation Analysis, 578

Reliability of Using the Mean Absolute Deviation to Derive Efficient E, V Farm Plans, 503

Risk Programming: An Aid in Planning Reservoir-Irrigation Systems, 249

Separable Programming for Considering Risk in Farm Planning, 260

Stepped Product Demand and Factor Supply Functions in Linear Programming Analyses, 116

Truncated Maximin Approach to Farm Planning Under Uncertainty with Discrete Probability Distributions (A), 192

Other

Shift-Share Analysis as a Technique in Rural Development Research, 267

Trend Models of Feeder, Slaughter, and Wholesale Beef Cattle Prices, 507

Simulation

Simulation Study of Population, Education, and Income Growth in Uganda (A): Comment, 524

Statistical

Combining Statistical Techniques with Economic Theory for Commodity Forecasting, 784

Harmonic Analysis of Seasonal Data: Some Important Properties, 646

Our Obsolete Data Systems: New Directions and Opportunities, 867 (Discussions, 875, 878)

Rural Appraisal and Taxation

Changing Federal Income Tax Rates and Optimum Farm Size, 490

Evaluation of Local Nonproperty Taxes for Rural and Urban Areas in Kansas, 635

Farmer Conservatism and the Incidence of Taxes, 485

Second Look at the Impact of Differential Assessment of Farmland and Consequent Tax Shifting (A): Comment, 679

Second Look at the Impact of Differential Assessment of Farmland and Consequent Tax Shifting (A): Reply, 682

Tax Loss Agricultural Investments After Tax Reform, 627

Social Welfare

Mechanization and Social Welfare: A Belated Comment, 537

Welfare Analysis of Poverty Programs, 809 (Discussions, 815, 817)

Socioeconomic Research

Socioeconomic Behavior of Cattle Ranchers, with Implications for Rural Community Development in the West, 217

Technological Change

General

Agricultural Technology and the Distribution of Welfare Gains, 801 (Discussions, 815, 817)

Allocation of Colleges and Economists, 934

Mechanization and Social Welfare: A Belated Comment, 537

Projections of Effects of Modern Inputs on Agricultural Income and Employment in a Community Development Block, Uttar Pradesh, India, 452

Technical Change and the Distribution of Income in Rural Areas, 326 (Discussions, 355, 357)

Innovation

- Predicting the Effects of High-Lysine Corn on the Hog Economy, 492

Trade

- Economic Analysis of the Quota on United States Beef Imports (An), 979

International

- Policy Environment for U. S. Agricultural Trade (The), 821 (Discussions, 834, 836, 837, 840)
World Trade Prospects for U. S. Agriculture, 827 (Discussions, 834, 836, 837, 840)

- Book Reviews, Feb., 147, May, 378, Aug., 539, Nov., 695
Books Received, Feb., 153, May, 387, Aug., 550, Nov., 703

- News Notes, Feb., 157, May, 396, Aug., 553, Nov., 710
First Award Paper in Undergraduate Student Essay Contest, Dec., 792

- Abstracts of Award-Winning Theses, Dec., 976
Reports and Minutes—American Agricultural Economics Association, Dec., 981

- AAEA Committee Structure, 1971–1972, May, 392

AUTHORS

- Adams, Dale W., *External Credit Policy for Latin America: Reply*, May, 365
Allee, David, J., *Discussion: Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment*, Dec., 901
Anderson, J. R., and John L. Dillon, *Allocative Efficiency, Traditional Agriculture, and Risk: Reply*, Aug., 524
Ayer, Harry W., and G. Edward Schuh, *Social Rates of Return and Other Aspects of Agricultural Research: The Case of Cotton Research in São Paulo, Brazil*, Nov., 557
Babb, Emerson, and Arlo J. Minden, *A Total Marketing System for U. S. Dairy Cooperatives*, May, 271
Back, William B., *Discussion: Income Maintenance Programs in the 1960's: A Survey*, May, 355
Baker, Chester B., and John T. Scott, Jr., *A Practical Way to Select an Optimum Farm Plan Under Risk*, Nov., 657
Barr, Wallace, *Discussion: World Trade Prospects for U. S. Agriculture*, Dec., 837
Barry, Peter J., *Asset Indivisibility and Investment Planning: An Application of Linear Programming*, May, 255
Bawden, D. Lee, *Welfare Analysis of Poverty Programs*, Dec., 809
Bell, David M., *The Impact of Air Pollution Abatement Activities of Coal-Burning Electric Power Generating Plants on the Fertilizer Industry*, Dec., 977
Berry, Russell L., *Break-Even Analysis: A Practical Tool in Farm Management*, Feb., 121
Bickel, Hans, and E. Ray Canterbury, *The Green Revolution: A Reply to Professors Ruttan and Mellor*, May, 366
Biere, Arlo W., *Discussion: Agricultural Productivity, Technology, and Environmental Quality*, Dec., 757
Biere, Arlo W., and Ivan M. Lee, *A Model for Managing Reservoir Water Releases*, Aug., 411
Bieri, J., A. de Janvry, and A. Nuñez, *Estimation of Demand Parameters Under Consumer Budgeting: An Application to Argentina*, Aug., 422
Bieri, Jurg, Alain de Janvry, and Andrew Schmitz, *Agricultural Technology and the Distribution of Welfare Gains*, Dec., 801
Blakeslee, Leroy, Wayne Thomas, LeRoy Rogers, and Norman Whittlesey, *Separable Programming for Considering Risk in Farm Planning*, May, 260
Blakley, Leo V., and Donald W. Kloth, *Price Alignment and Movements of Class I Milk Between Markets*, Aug., 496
Boehlje, Michael D., and Ludwig M. Eisgruber, *Strat-*

- egies for the Creation and Transfer of the Farm Estate*, Aug., 461

- Bonnen, James T., James Hildreth, George Judge, George Tolley, and Harry Trelogan, *Our Obsolete Data Systems: New Directions and Opportunities*, Dec., 867

- Bottom, John S., *Discussion: Community Development in the 1970's*, Dec., 773

- Boxley, Robert F., *Economics of Cropshare, Once Again: Reply*, Nov., 688

- Brelmyer, Harold F., *Tradition and Protectionism—The AAEA and Its Journal: Comment*, Aug., 520

- Brinkman, George L., *The Effects of Zero Population Growth on the Spatial Distribution of Economic Activity*, Dec., 964

- Bromley, Daniel W., *A Dynamic Economic Model of Pasture and Range Investments: Comment*, Feb., 131

- Bryant, W. Keith, *An Analysis of the Market for Food Stamps*, May, 305

- Bryant, W. Keith, *An Analysis of the Market for Food Stamps: Correction and Extension*, Nov., 689

- Burt, Oscar R., *A Dynamic Economic Model of Pasture and Range Investments: Reply*, Feb., 131

- Burt, Oscar R., *More Sophisticated Tools for Less Important Problems: The History of Range Improvement Research: Reply*, Feb., 134

- Burt, Oscar R., *Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches—Rejoinder*, Aug., 528

- Callen, Richard W., J. Michael Sprott, and Russell G. Thompson, *Demand, Supply, and Price Relationships for the Broiler Sector, With Emphasis on the Jack-Knife Method*, May, 245

- Candler, Wilfred, James C. Snyder, and William Faught, *Concave Programming Applied to Rice Mill Location*, Feb., 126

- Canterbury, E. Ray, and Hans Bickel, *The Green Revolution: A Reply to Professors Ruttan and Mellor*, May, 366

- Carman, Hoy F., *Changing Federal Income Tax Rates and Optimum Farm Size*, Aug., 490

- Carman, Hoy F., *Tax Loss Agricultural Investments After Tax Reform*, Nov., 627

- Casler, George L., *Economic and Policy Implications of Pollution from Agricultural Chemicals: Comment*, Aug., 534

- Castle, Emery N., *Economics and the Quality of Life*, Dec., 723

- Castle, Emery N., *Has the AAEA Become "Awards Happy"? A Reply*, Feb., 140

- Chapman, Duane, *A Note on Uncertainty and Non-market Cost*, Nov., 652
- Chen, Dean, Richard Courtney, and Andrew Schmitz, *A Polynomial Lag Formulation of Milk Production Response*, Feb., 77
- Ching, C. T. K., and G. E. Frick, *A Second Look at the Impact of Differential Assessment of Farmland and Consequent Tax Shifting: Reply*, Nov., 682
- Colyer, Dale, *External Credit Policy for Latin America: Comment*, May, 364
- Conner, J. R., R. J. Freund, and M. R. Godwin, *Risk Programming: An Aid in Planning Reservoir-Irrigation Systems*, May, 249
- Courtney, Richard, Dean Chen, and Andrew Schmitz, *A Polynomial Lag Formulation of Milk Production Response*, Feb., 77
- Cramer, Gail L., *Ph.D. Dissertation Awards: Does the Best Always Win? Comment*, Feb., 141
- Craven, John A., Richard J. Foote, and Robert R. Williams, Jr., *Quarterly Models to Predict Cash Prices of Pork Bellies*, Nov., 603
- Crow, J. Richard, John B. Riley, and Wayne D. Purcell, *Economic Implications of Nonpar Delivery Points for the Live Cattle Futures Contract*, Feb., 111
- Crowder, Richard T., *Statistical vs. Judgment and Audience Considerations in the Formulation and Use of Econometric Models*, Dec., 779
- Curtis, Wayne C., *Shift-Share Analysis as a Technique in Rural Development Research*, May, 267
- Dalrymple, Dana G., *Mechanization and Social Welfare: A Belated Comment*, Aug., 537
- Daly, Herman E., *In Defense of a Steady-State Economy*, Dec., 945
- Dardis, R., and B. Smith, *Inter-Fiber Competition and the Future of the United States Cotton Industry*, May, 209
- Davis, J. Ronnie, and Charles W. Meyer, *Farmer Conservatism and the Incidence of Taxes*, Aug., 485
- de Janvry, Alain, *The Generalised Power Production Function*, May, 234
- de Janvry, Alain, *Optimal Levels of Fertilization Under Risk: The Potential for Corn and Wheat Fertilization Under Alternative Price Policies in Argentina*, Feb., 1
- de Janvry, Alain, *Optimal Levels of Fertilization Under Risk: Reply*, Nov., 685
- de Janvry, Alain, Jurg Bieri, and Andrew Schmitz, *Agricultural Technology and the Distribution of Welfare Gains*, Dec., 801
- de Janvry, A., J. Bieri, and A. Nuñez, *Estimation of Demand Parameters Under Consumer Budgeting: An Application to Argentina*, Aug., 422
- Dillon, John L., and J. R. Anderson, *Allocative Efficiency, Traditional Agriculture, and Risk: Reply*, Aug., 524
- Dobson, W. D., G. Gunnelson, and S. Pamperin, *Analysis of the Accuracy of USDA Crop Forecasts*, Nov., 639
- Doeksen, Gerald Arthur, *A Social Accounting System and Simulation Model Projecting Economic Variables and Analyzing the Structure of the Oklahoma Economy*, Dec., 978
- Doeksen, Gerald A., and Dean F. Schreiner, *Investments in Agricultural Processing for Rural Development in Oklahoma*, Aug., 513
- Doll, John P., *A Comparison of Annual Versus Average Optima for Fertilizer Experiments*, May, 226
- Doll, John P., *An Econometric Analysis of Shrimp Ex-Vessel Prices, 1950-1968*, Aug., 431
- Doran, H. E., and J. J. Quilkey, *Harmonic Analysis of Seasonal Data: Some Important Properties*, Nov., 646
- Duft, Ken D., *Discussion: Research Support for Continuing Education*, Dec., 930
- Dunn, Edgar S., Jr., *Discussion: Our Obsolete Data Systems: New Directions and Opportunities*, Dec., 878
- Durant, Fred J., *Economic Analysis of Financial Growth Strategies for Large Pennsylvania Dairy Farms Under Competitive Labor Conditions*, Dec., 979
- Eckland, Bruce K., *Discussion: Causes and Consequences of Higher Education: Models of the Status Attainment Process*, Dec., 863
- Eldman, Vernon R., and Ronald D. Lacowell, *A General Model for Evaluating Agricultural Flood Plains*, Feb., 92
- Eiler, Doyle A., and Eddy L. LaDue, *Needed: More Efficient Use of Computer Resources*, Nov., 693
- Eisgruber, Ludwig M., *Research Support for Continuing Education*, Dec., 922
- Eisgruber, Ludwig M., and Michael D. Boehlje, *Strategies for the Creation and Transfer of the Farm Estate*, Aug., 461
- Elefson, Vern, *Quantitative Training of Undergraduates: Comment*, Aug., 531
- Elliott, David P., *Converting National Supply and Demand Equations to a Common Currency for Internationally Traded Commodities*, Aug., 538
- Faris, J. Edwin, *Discussion: Alternatives to the Neoclassical Theory of the Firm (NTF)*, May, 303
- Farris, D. E., and J. M. Sprott, *Economic and Policy Implications of Pollution from Agricultural Chemicals: Reply*, Aug., 536
- Faught, William, James C. Snyder, and Wilfred Candler, *Concave Programming Applied to Rice Mill Location*, Feb., 126
- Firch, Robert S., *A Market-Share Approach to the Foreign Demand for U. S. Cotton: Comment*, May, 375
- Foote, Richard J., John A. Craven, and Robert R. Williams, Jr., *Quarterly Models to Predict Cash Prices of Pork Bellies*, Nov., 603
- Franzmann, John R., and Rodney L. Walker, *Trend Models of Feeder, Slaughter, and Wholesale Beef Cattle Prices*, Aug., 507
- Freund, R. J., J. R. Conner, and M. R. Godwin, *Risk Programming: An Aid in Planning Reservoir-Irrigation Systems*, May, 249
- Frick, G. E., and C. T. K. Ching, *A Second Look at the Impact of Differential Assessment of Farmland and Consequent Tax Shifting: Reply*, Nov., 682
- Gardner, Bruce, *Minimum Wages and the Farm Labor Market*, Aug., 473
- Gardner, B. Delworth, *Discussion: Welfare Analysis of Poverty Programs*, Dec., 817
- Georgescu-Roegen, Nicholas, *Process Analysis and the Neoclassical Theory of Production*, May, 279
- Godfrey, E. Bruce, and Joe B. Stevens, *Use Rates, Resource Flows, and Efficiency of Public Investment in Range Improvements*, Nov., 611
- Godwin, M. R., J. R. Conner, and R. J. Freund, *Risk Programming: An Aid in Planning Reservoir-Irrigation Systems*, May, 249
- Gotsch, Carl H., *Technical Change and the Distribution of Income in Rural Areas*, May, 326

- Grove, Ernest W., *Has the AAEA Become "Awards Happy"? A Comment*, Feb., 139
- Gunnelson, G., W. D. Dobson, and S. Pamperin, *Analysis of the Accuracy of USDA Crop Forecasts*, Nov., 639
- Hallberg, M. C., *Assembly and Distribution System Management: An Application of Lockset*, Nov., 661
- Hammonds, Timothy M., and A. Gene Nelson, *Predicting the Effects of High-Lysine Corn on the Hog Economy*, Aug., 492
- Hauser, Robert M., and William H. Sewell, *Causes and Consequences of Higher Education: Models of the Status Attainment Process*, Dec., 851
- Hayami, Yujiro, *Rice Policy in Japan's Economic Development*, Feb., 19
- Hazell, P. B. R., and K. J. Thomson, *Reliability of Using the Mean Absolute Deviation to Derive Efficient E/V Farm Plans*, Aug., 503
- Headley, J. Charles, *Agricultural Productivity, Technology, and Environmental Quality*, Dec., 749
- Heady, Earl O., *Allocations of Colleges and Economists*, Dec., 934
- Heady, Earl O., *Optimal Sizes of Farms under Varying Tenure Forms, Including Renting, Ownership, State, and Collective Structures: Reply*, Feb., 143
- Heady, Earl O., and Daryll E. Ray, *Government Farm Programs and Commodity Interaction: A Simulation Analysis*, Nov., 578
- Heady, Earl O., Keith D. Rogers, and Uma K. Srivastava, *Modified Price, Production, and Income Impacts of Food Aid Under Market Differentiated Distribution*, May, 201
- Hildreth, James, George Judge, George Tolley, Harry Trelogan, and James T. Bonnen, *Our Obsolete Data Systems: New Directions and Opportunities*, Dec., 867
- Hildreth, R. J., and W. Neill Schaller, *Community Development in the 1970's*, Dec., 764
- Hite, James C., *Discussion: Agricultural Productivity, Technology, and Environmental Quality*, Dec., 759
- Ho, Foo-Shiung, and Richard A. King, *A Low-Cost Spatial Equilibrium Solution Procedure*, May, 373
- Horowitz, U., and D. Yaron, *A Sequential Programming Model of Growth and Capital Accumulation of a Farm Under Uncertainty*, Aug., 441
- Houck, J. P., and M. E. Ryan, *Supply Analysis for Corn in the United States: The Impact of Changing Government Programs*, May, 184
- Jackson, Geoffrey H., *An Economic Analysis of the Quota on United States Beef Imports*, Dec., 979
- Johnson, Glenn L., *Alternatives to the Neoclassical Theory of the Firm (NTF)*, May, 295
- Johnson, Paul R., *A Market-Share Approach to the Foreign Demand for U. S. Cotton: Reply*, May, 376
- Johnston, Warren E., *Economics of Size and the Spatial Distribution of Land in Farming Units*, Nov., 654
- Jones, Lonnie L., Curtis F. Lard, and Lester V. Manderscheid, *Present Status of Quantitative Techniques in Undergraduate Agricultural Economics Programs*, Feb., 102
- Jones, Lonnie L., Lester V. Manderscheid, and Curtis F. Lard, *On the Evaluation of Departments of Agricultural Economics: Reply*, Aug., 534
- Jones, Lonnie L., Lester V. Manderscheid, and Curtis F. Lard, *Quantitative Training of Undergraduates: Reply*, Aug., 532
- Judge, George, George Tolley, Harry Trelogan, James T. Bonnen, and James Hildreth, *Our Obsolete Data Systems: New Directions and Opportunities*, Dec., 867
- Kalter, Robert J., and Thomas H. Stevens, *Changed Distribution of Income vs. Redistribution in Public Project Evaluation: A Reply*, Feb., 137
- Kaminsky, Mario, *The Structure of Production of Multiple-Output Dairy Farms in the "Centro Santaferino" Region of Argentina: A Multivariate Analysis*, Dec., 977
- Kawaguchi, T., and Y. Maruyama, *Generalized Constrained Games in Farm Planning*, Nov., 591
- Kim, Kwan S., *Economics of Cropshare, Once Again: Comment*, Nov., 686
- King, Richard A., *Discussion: Welfare Analysis of Poverty Programs*, Dec., 815
- King, Richard A., and Foo-Shiung Ho, *A Low-Cost Spatial Equilibrium Solution Procedure*, May, 373
- Kloth, Donald W., and Leo V. Blakley, *Price Alignment and Movements of Class I Milk Between Markets*, Aug., 496
- Kneese, Allen V., *Discussion: Theory of the Firm and The Management of Residuals*, May, 322
- Kolmer, Lee R., *Delivery Systems for Continuing Education*, Dec., 916
- Kuang, Harvey H. S., *Allocation of Random Supply of Tomatoes of Varied Quality Produced in Different Areas Among Plants Producing Multiple Product Lines*, Dec., 790
- Kulshreshtha, S. N., and A. G. Wilson, *An Open Econometric Model of the Canadian Beef Cattle Sector*, Feb., 84
- Lacewell, Ronald D., and Vernon R. Eidman, *A General Model for Evaluating Agricultural Flood Plains*, Feb., 92
- LaDue, Eddy L., and Doyle A. Eiler, *Needed: More Efficient Use of Computer Resources*, Nov., 693
- Langham, Max R., *Theory of the Firm and The Management of Residuals*, May, 315
- Lard, Curtis F., Lonnie L. Jones, and Lester V. Manderscheid, *Present Status of Quantitative Techniques in Undergraduate Agricultural Economics Programs*, Feb., 102
- Lard, Curtis F., Lonnie L. Jones, and Lester V. Manderscheid, *On the Evaluation of Departments of Agricultural Economics: Reply*, Aug., 534
- Lard, Curtis F., Lonnie L. Jones, and Lester V. Manderscheid, *Quantitative Training of Undergraduates: Reply*, Aug., 532
- Lau, Lawrence J., and Pan A. Yotopoulos, *Profit, Supply, and Factor Demand Functions*, Feb., 11
- Lee, Ivan M., and Arlo W. Biere, *A Model for Managing Reservoir Water Releases*, Aug., 411
- Lee, John E., Jr., *Discussion: Our Obsolete Data Systems: New Directions and Opportunities*, Dec., 875
- Lewis, Kenneth A., *An Econometric Analysis of the Demand for Textile Fibers*, May, 238
- Lianos, Theodore P., *Impact of Minimum Wages Upon the Level and Composition of Agricultural Employment*, Aug., 477
- Lianos, Theodore P., and Quirino Paris, *American Agriculture and the Prophecy of Increasing Misery*, Nov., 570
- Lianos, Theodore P., and Edith Hall Parker, *Discrimination in the Markets for Farm Capital? Comment*, May, 369
- Little, Joseph W., *Discussion: Analytical Institutional*

- Economics: Challenging Problems in the Economics of Resources for a New Environment*, Dec., 905
- Maddox, James G., *Discussion: Southern Tradition and Regional Progress: A Perspective from the 1970's*, Dec., 745
- Manderscheid, Lester V., Lonnie L. Jones, and Curtis F. Lard, *Present Status of Quantitative Techniques in Undergraduate Agricultural Economics Programs*, Feb., 102
- Manderscheid, Lester V., Lonnie L. Jones, and Curtis F. Lard, *Quantitative Training of Undergraduates: Reply*, Aug., 532
- Mann, Charles K., *Taste, Technology, and the Government: The Case of Tobacco*, Dec., 976
- Martin, Neil R., Jr., *Stepped Product Demand and Factor Supply Functions in Linear Programming Analyses*, Feb., 116
- Martin, William E., *Discussion: Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment*, Dec., 903
- Martin, William E., *More Sophisticated Tools for Less Important Problems: The History of Range Improvement Research: A Comment*, Feb., 132
- Martin, William E., and Arthur H. Smith, *Socioeconomic Behavior of Cattle Ranchers, with Implications for Rural Community Development in the West*, May, 217
- Maryama, Yoshihiro, *A Truncated Maximin Approach to Farm Planning Under Uncertainty with Discrete Probability Distributions*, May, 192
- Maryama, Y., and T. Kawaguchi, *Generalized Constrained Games in Farm Planning*, Nov., 591
- Mayer, Leo V., *Estimated Net Costs of P.L. 480 Food Aid with Three Alternative U. S. Farm Programs*, Feb., 41
- McGaughey, Stephen E., and Erik Thorbecke, *Project Selections and Macroeconomic Objectives: A Methodology Applied to Peruvian Irrigation Projects*, Feb., 32
- McMinimy, Vernon, and Ted Rice, *Discussion: World Trade Prospects for U. S. Agriculture*, Dec., 836
- McMurtry, Gene, *Discussion: Community Development in the 1970's*, Dec., 776
- Mellor, John W., *The Green Revolution: A Reply To Professors Ruttan and Mellor: A Further Reply*, May, 368
- Meyer, Charles W., and J. Ronnie Davis, *Farmer Conservatism and the Incidence of Taxes*, Aug., 485
- Miller, Thomas A., *Evaluation of Alternative Flexibility Restraint Procedures for Recursive Programming Models Used for Prediction*, Feb., 68
- Minden, Arlo J., and Emerson Babb, *A Total Marketing System for U. S. Dairy Cooperatives*, May, 271
- Molster, H. C., *Allocative Efficiency, Traditional Agriculture, and Risk: Comment*, Aug., 522
- Muench, John, Jr., *Public Pressures and Values, Federal Policy Changes, and Future Timber Supply*, Dec., 881
- Myers, Walter M., *Combining Statistical Techniques with Economic Theory for Commodity Forecasting*, Dec., 784
- Narrie, David B., *On the Evaluation of Departments of Agricultural Economics: Comment*, Aug., 532
- Nelson, A. Gene, and Timothy M. Hammonds, *Predicting the Effects of High-Lysine Corn on the Hog Economy*, Aug., 492
- Nelson, Paul E., Jr., *Michigan Food Stamp Program: A Partial Analysis of Performance*, Feb., 51
- Nicholls, William H., *Southern Tradition and Regional Progress: A Perspective from the 1970's*, Dec., 736
- Norvell, Douglass G., *A Simulation Study of Population, Education, and Income Growth in Uganda: Comment*, Aug., 524
- Nuñez, A., A. de Janvry, and J. Bieri, *Estimation of Demand Parameters Under Consumer Budgeting: An Application to Argentina*, Aug., 422
- Orazem, Frank, and Ronald G. Trostle, *Evaluation of Local Nonproperty Taxes for Rural and Urban Areas in Kansas*, Nov., 635
- Owens, Emiel W., *Income Maintenance Programs in the 1960's: A Survey*, May, 342
- Pamperin, S., W. D. Dobson, and G. Gunnelson, *Analysis of the Accuracy of USDA Crop Forecasts*, Nov., 639
- Paris, Quirino, and Theodore P. Lianos, *American Agriculture and the Prophecy of Increasing Misery*, Nov., 570
- Parker, Edith Hall, and Theodore P. Lianos, *Discrimination in the Markets for Farm Capital? Comment*, May, 369
- Pasour, E. C., Jr., *Legal and Economic Rights of Holders of Government Allotments*, Nov., 622
- Pearce, William R., *Discussion: World Trade Prospects for U. S. Agriculture*, Dec., 834
- Penson, John B., Jr., *Demand for Financial Assets in the Farm Sector: A Portfolio Balance Approach*, May, 163
- Perelman, Michael, *Sacred Cows*, Aug., 526
- Perrin, R. K., *Asset Replacement Principles*, Feb., 60
- Perrin, Richard K., *Optimal Levels of Fertilization Under Risk: Comment*, Nov., 683
- Polopolus, Leo, and John C. Redman, *Tradition and Protectionism—The AAEA and Its Journal: Reply*, Aug., 521
- Purcell, Wayne D., Richard J. Crow, and John B. Riley, *Economic Implications of Nonpar Delivery Points for the Live Cattle Futures Contract*, Feb., 111
- Quance, Leroy, and Luther Tweenen, *Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches—A Further Reply*, Aug., 530
- Quilkey, J. J., and H. E. Doran, *Harmonic Analysis of Seasonal Data: Some Important Properties*, Nov., 646
- Randall, Alan, *Market Solutions to Externality Problems: Theory and Practice*, May, 175
- Ratnam, Nittala V., and Heinz, Spielmann, *Consumer Attitudes and Their Impact on Fluid Milk Demand in Hawaii: A Component-Regression Analysis Approach*, Nov., 671
- Ray, Darryl E., and Earl O. Heady, *Government Farm Programs and Commodity Interaction: A Simulation Analysis*, Nov., 578
- Redfern, J. Martin, *Discussion: Income Maintenance Programs in the 1960's: A Survey*, May, 357
- Redman, John C., *Locational Distribution of AAEA Membership and Journal Contribution*, Feb., 145
- Redman, John C., and Leo Polopolus, *Tradition and Protectionism—The AAEA and Its Journal: Reply*, Aug., 521
- Rice, Ted, and Vernon McMinimy, *Discussion: World Trade Prospects for U. S. Agriculture*, Dec., 836
- Ricker, William D., *An Analytical Approach to the Consolidation of Counties in North and West Florida Based on Educational Efficiency Criteria*, Dec., 980
- Riley, John B., Richard J. Crow, and Wayne D. Purcell, *Economic Implications of Nonpar Delivery*

- Points for the Live Cattle Futures Contract*, Feb., 111
- Rogers, Keith D., Uma K. Srivastava, and Earl O. Heady, *Modified Price, Production, and Income Impacts of Food Aid Under Market Differentiated Distribution*, May, 201
- Rogers, LeRoy, Wayne Thomas, Leroy Blakeslee, and Norman Whittlesey, *Separable Programming for Considering Risk in Farm Planning*, May, 260
- Ryan, M. E., and J. P. Houck, *Supply Analysis for Corn in the United States: The Impact of Changing Government Programs*, May, 184
- Schallau, Con H., *Discussion: Public Pressures and Values, Federal Policy Changes, and Future Timber Supply*, Dec., 889
- Schaller, W. Neill, and R. J. Hildreth, *Community Development in the 1970's*, Dec., 764
- Schmid, A. Allan, *Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment*, Dec., 893
- Schmid, A. Allan, *Changed Distribution of Income vs. Redistribution in Public Project Evaluation: Comment*, Feb., 135
- Schmitz, Andrew, Dean Chen, and Richard Courtney, *A Polynomial Lag Formulation of Milk Production Response*, Feb., 77
- Schmitz, Andrew, Alain de Janvry, and Jurg Bieri, *Agricultural Technology and the Distribution of Welfare Gains*, Dec., 801
- Schoeplein, Justine Dakin, and Robert N. Schoeplein, *A Second Look at the Impact of Differential Assessment of Farmland and Consequent Tax Shifting: Comment*, Nov., 679
- Schoeplein, Robert N., and Justine Dakin Schoeplein, *A Second Look at the Impact of Differential Assessment of Farmland and Consequent Tax Shifting: Comment*, Nov., 679
- Schreiner, Dean F., and Gerald A. Doeksen, *Investments in Agricultural Processing for Rural Development in Oklahoma*, Aug., 513
- Schuh, G. Edward, and Harry W. Ayer, *Social Rates of Return and Other Aspects of Agricultural Research: The Case of Cotton Research in São Paulo, Brazil*, Nov., 557
- Schultz, Theodore W., *The Increasing Economic Value of Human Time*, Dec., 843
- Scott, John T., Jr., and Chester B. Baker, *A Practical Way to Select an Optimum Farm Plan Under Risk*, Nov., 657
- SeEVERS, Gary L., *The Policy Environment for U. S. Agricultural Trade*, Dec., 821
- Serow, William J., *The Implications of Zero Growth for Agricultural Commodity Demand*, Dec., 955
- Sewell, William H., and Robert M. Hauser, *Causes and Consequences of Higher Education: Models of the Status Attainment Process*, Dec., 851
- Skok, Richard A., *Discussion: Public Pressures and Values, Federal Policy Changes, and Future Timber Supply*, Dec., 887
- Smith, Allen G., *Is There Disinvestment in the Farming Sector?*, May, 275
- Smith, Arthur H., and William E. Martin, *Socioeconomic Behavior of Cattle Ranchers, with Implications for Rural Community Development in the West*, May, 217
- Smith B., and R. Dardis, *Inter-Fiber Competition and the Future of the United States Cotton Industry*, May, 209
- Smith, Eldon D., *Agricultural Marketing Research for Less-Developed Areas*, Nov., 666
- Snyder, James C., Wilfred Candler, and William Faught, *Concave Programming Applied to Rice Mill Location*, Feb., 126
- Sparks, Willard R., *An Industrial Perspective on Agricultural Policy in the 1970's*, Dec., 797
- Spengler, J. J., *Discussion: Southern Tradition and Regional Progress: A Perspective from the 1970's*, Dec., 747
- Spielmann, Heinz, and Nittala V. Ratnam, *Consumer Attitudes and Their Impact on Fluid Milk Demand in Hawaii: A Component-Regression Analysis Approach*, Nov., 671
- Sprott, J. M., and D. E. Farris, *Economic and Policy Implications of Pollution from Agricultural Chemicals: Reply*, Aug., 536
- Sprott, J. Michael, Russell G. Thompson, and Richard W. Callen, *Demand, Supply, and Price Relationships for the Broiler Sector, With Emphasis on the Jack-Knife Method*, May, 245
- Srivastava, Uma K., Keith D. Rogers, and Earl O. Heady, *Modified Price, Production, and Income Impacts of Food Aid Under Market Differentiated Distribution*, May, 201
- Stanton, B. F., *Clientele for Continuing Education in the 1970's*, Dec., 910
- Stevens, Joe B., and E. Bruce Godfrey, *Use Rates, Resource Flows, and Efficiency of Public Investment in Range Improvements*, Nov., 611
- Stevens, Thomas H., and Robert J. Kalter, *Changed Distribution of Income vs. Redistribution in Public Project Evaluation: A Reply*, Feb., 137
- Stoevener, Herbert H., *Discussion: Agricultural Productivity, Technology, and Environmental Quality*, Dec., 761
- Taeuber, Conrad, *Future Census Data for Agriculture: Comment*, May, 360
- Tetro, Robert C., *Discussion: World Trade Prospects for U. S. Agriculture*, Dec., 840
- Thomas, Wayne, Leroy Blakeslee, LeRoy Rogers, and Norman Whittlesey, *Separable Programming for Considering Risk in Farm Planning*, May, 260
- Thompson, Russell G., J. Michael Sprott, and Richard W. Callen, *Demand, Supply, and Price Relationships for the Broiler Sector, With Emphasis on the Jack-Knife Method*, May, 245
- Thomson, K. J., and P. B. R. Hazell, *Reliability of Using the Mean Absolute Deviation to Derive Efficient B,V Farm Plans*, Aug., 503
- Thorbecke, Erik, and Stephen E. McGaughey, *Project Selection and Macroeconomic Objectives: A Methodology Applied to Peruvian Irrigation Projects*, Feb., 32
- Tinney, Robert, and Finis Welch, *Discrimination in Markets for Farm Capital? Reply*, May, 371
- Tolley, George, Harry Trelogan, James T. Bonnen, James Hildreth, and George Judge, *Our Obsolete Data Systems: New Directions and Opportunities*, Dec., 867
- Tomek, William G., *Distributed Lag Models of Cotton Acreage Response: A Further Result*, Feb., 108
- Trelogan, Harry C., *Future Census Data for Agriculture: Reply*, May, 363

- Trelogan, Harry, James T. Bonnen, James Hildreth, George Judge, and George Tolley, *Our Obsolete Data Systems: New Directions and Opportunities*, Dec., 867
- Trostle, Ronald G., and Frank Orazem, *Evaluation of Local Nonproperty Taxes for Rural and Urban Areas in Kansas*, Nov., 635
- Tweeten, Luther, *Discussion: Causes and Consequences of Higher Education: Models of the Status Attainment Process*, Dec., 862
- Tweeten, Luther, and Leroy Quance, *Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches—A Further Reply*, Aug., 530
- Ulveling, Edwin F., *Optimal Sizes of Farms Under Varying Tenure Forms, Including Renting, Ownership, State, and Collective Structures*, Feb., 142
- Vaidya, Klrit G., *Evaluation of Indian Fertilizer Projects: An Application of Consumer's and Producer's Surplus: Comment*, May, 371
- Walker, Rodney L., and John R. Franzmann, *Trend Models of Feeder, Slaughter, and Wholesale Beef Cattle Prices*, Aug., 507
- Welch, Finis, and Robert Tinney, *Discrimination in Markets for Farm Capital? Reply*, May, 371
- West, Quentin M., *World Trade Prospects for U. S. Agriculture*, Dec., 827
- Whittlesey, Norman, LeRoy Rogers, Wayne Thomas, and Leroy Blakeslee, *Separable Programming for Considering Risk in Farm Planning*, May, 260
- Williams, Robert R., Jr., John A. Craven, and Richard J. Foote, *Quarterly Models to Predict Cash Prices of Pork Bellies*, Nov., 603
- Williams, T. T., *Discussion: Research Support for Continuing Education*, Dec., 928
- Wills, Ian R., *Projections of Effects of Modern Inputs on Agricultural Income and Employment in a Community Development Block, Uttar Pradesh, India*, Aug., 452
- Wilson, A. G., and S. N. Kulshreshtha, *An Open Econometric Model of the Canadian Beef Cattle Sector*, Feb., 84
- Wood, John E., *Analysis for Potential Hedging Criteria for Live Hogs Using Seasonal Indices*, Dec., 972
- Yaron, D., and U. Horowitz, *A Sequential Programming Model of Growth and Capital Accumulation of a Farm Under Uncertainty*, Aug., 441
- Yoho, James G., *Discussion: Public Pressures and Values, Federal Policy Changes, and Future Timber Supply*, Dec., 890
- Yotopoulos, Pan A., and Lawrence J. Lau, *Profit, Supply, and Factor Demand Functions*, Feb., 11
- Yver, Raul E., *The Investment Behavior and the Supply Response of the Cattle Industry in Argentina*, Dec., 976

REVIEWS

By author of publication—reviewer in parentheses

- Arthur, Henry B., *Commodity Futures As a Business Management Tool* (Aaron C. Johnson, Jr.), May, 378
- Ball, A. Gordon, and Earl O. Heady (eds.), *Size, Structure, and Future of Farms* (W. L. Gibson, Jr.), Nov., 695
- Barkley, Paul W., and David W. Seckler, *Economic Growth and Environmental Decay: The Solution Becomes the Problem* (A. Allan Schmid), Nov., 696
- Berger, Samuel R., *Dollar Harvest* (Don F. Hadwiger), Aug., 539
- Blase, Melvin G. (ed.), *Institutions in Agricultural Development* (Russell H. Brannon), May, 379
- Boulding, Kenneth E., Elvis J. Stahr, Solomon Fabricant, and Martin R. Gainsburgh, *Economics of Pollution* (A. Allan Schmid), Nov., 696
- Brubaker, Sterling, *To Live On Earth: Man and His Environment in Perspective* (A. Allan Schmid), Nov., 696
- Capstick, Margaret, *The Economics of Agriculture* (Reuben C. Buse), Feb., 147
- Chao, Kang, *Agricultural Production in Communist China 1949-1965* (Shun-Hsin Chou), May, 379
- Corden, W. M., *The Theory of Protection* (Larry J. Wipf), Feb., 148
- Cowling, Keith, David Metcalf, and A. J. Rayner, *Resource Structure of Agriculture: An Economic Analysis* (Norman K. Whittlesey), Aug., 540
- Dhrymes, Phoebus J., *Econometrics, Statistical Foundations and Applications* (John P. Doll), May, 381
- Dorner, Peter (ed.), *Land Reform in Latin America, Issues and Cases* (C. O. Andrew), Nov., 698
- Evans, John W., *The Kennedy Round in American Trade Policy: The Twilight of the GATT?* (Vernon L. Sorenson), Nov., 700
- Falcon, Walter P., and Gustav F. Papanek (eds.), *Development Policy II—The Pakistan Experience* (M. Raquibuz Zaman), Aug., 541
- Fishel, Walter L. (ed.), *Resource Allocation in Agricultural Research* (Linley E. Juers), Aug., 542
- Geer, Thomas, *An Oligopoly: The World Coffee Economy and Stabilization Schemes* (M. M. Veeman), Nov., 699
- Greig, W. Smith, *The Economics of Food Processing* (Alden C. Manchester), Aug., 543
- Grogan, F. O. (ed.), *International Trade in Temperate Zone Products* (Vernon L. Sorenson), Nov., 700
- Halter, Albert N., and Gerald W. Dean, *Decisions Under Uncertainty with Research Applications* (Wilfred Candler), Feb., 149
- Heady, Earl O. (ed.), *Economic Models and Quantitative Methods for Decisions and Planning in Agriculture* (George D. Irwin), Feb., 149
- Hicks, George L., and Geoffrey McNicoll, *Trade and Growth in the Philippines: An Open Dual Economy* (Vernon W. Ruttan), Aug., 544
- Hieronymus, Thomas A., *Economics of Futures Trading, for Commercial and Personal Profit* (Roger W. Gray), Aug., 545
- Howe, Charles W., and K. William Easter, *Interbasin Transfers of Water* (Joe B. Stevens), Feb., 150
- Intriligator, Michael D., *Mathematical Optimization and Economic Theory* (Takashi Takayama), May, 383
- Kilby, Peter (ed.), *Entrepreneurship and Economic Development* (Matthew Edel), Aug., 546
- Kmenta, Jan, *Elements of Econometrics* (John P. Doll), May, 381
- Kuznets, Simon, *Economic Growth of Nations; Total*

- Output and Production Structure* (Theodore W. Schultz), Feb., 151
- Myers, Ramon H., *The Chinese Peasant Economy: Agricultural Development in Hopei and Shantung, 1890-1949* (Shun-Hsin Chou), May, 379
- Nelson, Richard R., T. Paul Schultz, and Robert L. Sleighton, *Structural Changes in a Developing Economy: Colombia's Problems and Prospects* (Dale W. Adams), May, 384
- Padberg, Daniel L., *Today's Food Broker: Vital Link in the Distribution Cycle* (Bob R. Holdren), Nov., 701
- Scherer, F. M., *Industrial Market Structure and Economic Performance* (Stephen H. Sosnick), Aug., 547
- Solow, Barbara Lewis, *The Land Question and the Irish Economy, 1870-1903* (Russell L. Berry), Aug., 548
- Steiner, Gilbert Y., *The State of Welfare* (W. Keith Bryant), May, 385
- Takayama, Takashi, and George G. Judge, *Spatial and Temporal Prices and Allocation Models* (Pinhas Zusan), Nov., 701
- Theil, Henri, *Principles of Econometrics* (John P. Doll), May, 381
- Volin, Lazar, *A Century of Russian Agriculture: From Alexander II to Khrushchev* (D. Gale Johnson), Feb., 151
- Wollman, Nathaniel, and Gilbert W. Bonem, *The Outlook for Water: Quality, Quantity, and National Growth* (William B. Lord), May, 386
- Wonnacott, R. J., and Thomas H. Wonnacott, *Econometrics* (John P. Doll), May, 381

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